prior to the update, determine whether the activity meets the social influence weight upgrade criteria.

768. The apparatus of claim 766, wherein the instructions to update the user's social influence profile based on the activity further comprises instructions to:

obtain social influence points associated with the activity; and

determine the social influence weight corresponding to the social influence points.

769. The apparatus of claim 768, wherein the processor issues further instructions to: obtain historical data corresponding to the user engagement in the activity; and

adjust the social influence points based on the historical data.

770. The apparatus of claim 766, wherein the activity is at least one of: (i) playlist creation; (ii) playlist sharing; (iii) media content rating; (iv) messaging; (v) posting; and (vi) influencing a number of users to play, download or purchase one or more tracks.

771. The apparatus of claim 766, wherein the processor issues further instructions to:

qualify the user for at least one promotional incentive based on the updated social influence profile.

772. The apparatus of claim 771, wherein the at least one promotional incentive is one: (i) purchase discount; (ii) free merchandise; and (iii) admission to events.

773. The apparatus of claim 771, wherein the processor issues further instructions to:

provide the user the at least one promotional incentive when the activity matches one or more activity criteria.

774. The apparatus of claim 766, wherein the socially influencing activity is related to at least one of: a social graph and an interest graph.

775. The apparatus of claim 770 wherein the processor issues further instructions to:

determine whether the activity is a URMC socially influencing activity.

776. The apparatus of claim 775, wherein the determination is based on tracked frequency of user engagement with a playlist sharing activity.

777. The apparatus of claim 775, wherein the determination is based on tracked license purchase attributable to the user.

778. The apparatus of claim 775, wherein the determination is based on tracked number of users following and unfollowing the user.

779. The apparatus of claim 775, wherein the determination is based on tracked response to content sharing.

780. The apparatus of claim 775, wherein the determination is based on tracked usage volume of other users attributable to the user.

781. A processor-implemented method, comprising:

detecting user initiation of a universally resolvable media content ("URMC") event in a client;

obtaining the URMC event identifying information;

recording the URMC event identifying information in association with the event in an event log in the client;

obtaining reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

determining activation of a URMC upload threshold trigger by evaluating the at least one URMC user activity upload rule;

initiating reporting of the logged URMC event identifying information based on the trigger activation; and

updating the client upon successful acknowledgement of said reporting by a server.

782. The method of claim 781, further comprising:

anonymizing the URMC event identifying information in the event log before initiating said reporting.

783. The method of claim 782, wherein a decision for anonymizing the URMC event identifying information is based on user preference information.

784. The method of claim 781, wherein when the client is disconnected from a communication network:

suspending said reporting until the client is connected to the communication network.

785. The method of claim 784, wherein when said reporting is suspended and a user initiation of a URMC event is detected,:

determining, using at least one URMC upload threshold rule, whether to disable contents of the URMC collection in the client.

786. The method of claim 781, wherein the URMC event is one of: (1) content started; (ii) content paused; (iii) content stopped; (iv) content skipped; and (v) application closed.

787. The method of claim 781, wherein the URMC event identifying information includes play session information including: play session start time, play session end time, total play session time for each content item in at least one of user library section, community section, discovery section and magic playlist.

788. The method of claim 781, wherein the URMC event identifying information includes at least one of: (i) content event name; (ii) event time stamp; (iii) universally resolvable content identifier; and (iv) user information.

789. The method of claim 781, wherein the at least one URMC user activity upload rule specifies a time for initiating reporting.

790. The method of claim 781, wherein the at least one URMC user activity upload rule specifies a number of URMC events for initiating reporting.

791. The method of claim 781, wherein the at least one URMC user activity upload rule specifies a number of each type of URMC event for initiating reporting.

792. The method of claim 781, further comprising categorizing the URMC event as at least one of: (i) play event; (ii) import event; (iii) share event; (iv) community event; and (v) search event.

793. The method of claim 792, further comprising selecting one or more URMC event categories for reporting based on the user's enrollment status in guru program.

794. The method of claim 792, wherein the reported URMC event identifying information is used for determining influence points attributable to one or more URMC service users.

795. The method of claim 792, wherein the reported URMC event identifying information is used for determining recommendations for the user.

796. The method of claim 792, wherein the reported URMC event identifying information is used for determining license payouts to URMC service partners.

797. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

detect user initiation of a universally resolvable media content ("URMC") event in a client;

obtain the URMC event identifying information;

record the URMC event identifying information in association with the event in an event log in the client;

obtain reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

determine activation of a URMC upload threshold trigger by evaluating the at least one URMC user activity upload rule;

initiate reporting of the logged URMC event identifying information based on the trigger activation; and

update the client upon successful acknowledgement of said reporting by a server.

798. The system of claim 797, further comprising instructions to:

anonymize the URMC event identifying information in the event log before initiating said reporting.

799. The system of claim 798, wherein a decision for anonymizing the URMC event identifying information is based on user preference information.

800. The system of claim 797, wherein when the client is disconnected from a communication network, providing instructions to:

suspend said reporting until the client is connected to the communication network.

801. The system of claim 800, wherein when said reporting is suspended and a user initiation of a URMC event is detected, providing instructions to:

determine, using at least one URMC upload threshold rule, whether to disable contents of the URMC collection in the client.

802. The system of claim 797, wherein the URMC event is one of: (1) content started; (ii) content paused; (iii) content stopped; (iv) content skipped; and (v) application closed.

803. The system of claim 797, wherein the URMC event identifying information includes play session information including: play session start time, play session end time, total play session time for each content item in at least one of user library section, community section, discovery section and magic playlist.

804. The system of claim 797, wherein the URMC event identifying information includes at least one of: (i) content event name; (ii) event time stamp; (iii) universally resolvable content identifier; and (iv) user information.

805. The system of claim 797, wherein the at least one URMC user activity upload rule specifies a time for initiating reporting.

806. The system of claim 797, wherein the at least one URMC user activity upload rule specifies a number of URMC events for initiating reporting.

807. The system of claim 797, wherein the at least one URMC user activity upload rule specifies a number of each type of URMC event for initiating reporting.

808. The system of claim 797, further comprising categorizing the URMC event as at least one of: (i) play event; (ii) import event; (iii) share event; (iv) community event; and (v) search event.

809. The system of claim 808, further comprising instructions to select one or more URMC event categories for reporting based on the user's enrollment status in guru program.

810. The system of claim 808, wherein the reported URMC event identifying information is used for determining influence points attributable to one or more URMC service users.

811. The system of claim 808, wherein the reported URMC event identifying information is used for determining recommendations for the user.

812. The system of claim 808, wherein the reported URMC event identifying information is used for determining license payouts to URMC service partners.

813. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

detect user initiation of a universally resolvable media content ("URMC") event in a client;

obtain the URMC event identifying information;

record the URMC event identifying information in association with the event in an event log in the client;

obtain reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

determine activation of a URMC upload threshold trigger by evaluating the at least one URMC user activity upload rule;

initiate reporting of the logged URMC event identifying information based on the trigger activation; and

update the client upon successful acknowledgement of said reporting by a server.

814. The medium of claim 813, further comprising instructions to:

anonymize the URMC event identifying information in the event log before initiating said reporting.

815. The medium of claim 814, wherein a decision for anonymizing the URMC event identifying information is based on user preference information.

816. The medium of claim 813, wherein when the client is disconnected from a communication network, providing instructions to:

suspend said reporting until the client is connected to the communication network.

817. The medium of claim 816, wherein when said reporting is suspended and a user initiation of a URMC event is detected, providing instructions to:

determine, using at least one URMC upload threshold rule, whether to disable contents of the URMC collection in the client.

818. The medium of claim 813, wherein the URMC event is one of: (1) content started; (ii) content paused; (iii) content stopped; (iv) content skipped; and (v) application closed.

819. The medium of claim 813, wherein the URMC event identifying information includes play session information including: play session start time, play session end time, total play session time for each content item in at least one of user library section, community section, discovery section and magic playlist.

820. The medium of claim 813, wherein the URMC event identifying information includes at least one of: (i) content event name; (ii) event time stamp; (iii) universally resolvable content identifier; and (iv) user information.

821. The medium of claim 813, wherein the at least one URMC user activity upload rule specifies a time for initiating reporting.

822. The medium of claim 813, wherein the at least one URMC user activity upload rule specifies a number of URMC events for initiating reporting.

823. The medium of claim 813, wherein the at least one URMC user activity upload rule specifies a number of each type of URMC event for initiating reporting.

824. The medium of claim 813, further comprising categorizing the URMC event as at least one of: (i) play event; (ii) import event; (iii) share event; (iv) community event; and (v) search event.

825. The medium of claim 824, further comprising instructions to select one or more URMC event categories for reporting based on the user's enrollment status in guru program.

826. The medium of claim 824, wherein the reported URMC event identifying information is used for determining influence points attributable to one or more URMC service users.

827. The medium of claim 824, wherein the reported URMC event identifying information is used for determining recommendations for the user.

828. The medium of claim 824, wherein the reported URMC event identifying information is used for determining license payouts to URMC service partners.

829. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

detect user initiation of a universally resolvable media content ("URMC") event in a client;

obtain the URMC event identifying information;

record the URMC event identifying information in association with the event in an event log in the client;

obtain reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

determine activation of a URMC upload threshold trigger by evaluating the at least one URMC user activity upload rule;

initiate reporting of the logged URMC event identifying information based on the trigger activation; and

update the client upon successful acknowledgement of said reporting by a server.

830. The apparatus of claim 829, further comprising instructions to:

anonymize the URMC event identifying information in the event log before initiating said reporting.

831. The apparatus of claim 830, wherein a decision for anonymizing the URMC event identifying information is based on user preference information.

832. The apparatus of claim 829, wherein when the client is disconnected from a communication network, providing instructions to:

suspend said reporting until the client is connected to the communication network.

833. The apparatus of claim 832, wherein when said reporting is suspended and a user initiation of a URMC event is detected, providing instructions to:

determine, using at least one URMC upload threshold rule, whether to disable contents of the URMC collection in the client.

834. The apparatus of claim 829, wherein the URMC event is one of: (1) content started; (ii) content paused; (iii) content stopped; (iv) content skipped; and (v) application closed.

835. The apparatus of claim 829, wherein the URMC event identifying information includes play session information including: play session start time, play session end time, total play session time for each content item in at least one of user library section, community section, discovery section and magic playlist.

836. The apparatus of claim 829, wherein the URMC event identifying information includes at least one of: (i) content event name; (ii) event time stamp; (iii) universally resolvable content identifier; and (iv) user information.

837. The apparatus of claim 829, wherein the at least one URMC user activity upload rule specifies a time for initiating reporting.

838. The apparatus of claim 829, wherein the at least one URMC user activity upload rule specifies a number of URMC events for initiating reporting.

839. The apparatus of claim 829, wherein the at least one URMC user activity upload rule specifies a number of each type of URMC event for initiating reporting.

840. The apparatus of claim 829, further comprising categorizing the URMC event as at least one of: (i) play event; (ii) import event; (iii) share event; (iv) community event; and (v) search event.

841. The apparatus of claim 840, further comprising instructions to select one or more URMC event categories for reporting based on the user's enrollment status in guru program.

842. The apparatus of claim 840, wherein the reported URMC event identifying information is used for determining influence points attributable to one or more URMC service users.

843. The apparatus of claim 840, wherein the reported URMC event identifying information is used for determining recommendations for the user.

844. The apparatus of claim 840, wherein the reported URMC event identifying information is used for determining license payouts to URMC service partners.

845. A processor-implemented method, comprising:

obtaining notification of a user initiation of a universally resolvable media content ("URMC") event in a client;

obtaining an event log recording the URMC event identifying information in association with the event;

providing reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

obtaining reporting of the logged URMC event identifying information that is triggered in accordance with at least one URMC user activity upload rule; and

providing an acknowledgment to the client upon obtaining said reporting.

846. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain notification of a user initiation of a universally resolvable media content ("URMC") event in a client;

obtain an event log recording the URMC event identifying information in association with the event;

provide reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

obtain reporting of the logged URMC event identifying information that is triggered in accordance with at least one URMC user activity upload rule; and

provide an acknowledgment to the client upon obtaining said reporting.

847. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

obtain notification of a user initiation of a universally resolvable media content ("URMC") event in a client;

obtain an event log recording the URMC event identifying information in association with the event;

provide reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

obtain reporting of the logged URMC event identifying information that is triggered in accordance with at least one URMC user activity upload rule; and

provide an acknowledgment to the client upon obtaining said reporting.

848. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain notification of a user initiation of a universally resolvable media content ("URMC") event in a client;

obtain an event log recording the URMC event identifying information in association with the event;

provide reporting frequency preference setting, wherein the preference setting includes at least one URMC user activity upload rule;

obtain reporting of the logged URMC event identifying information that is triggered in accordance with at least one URMC user activity upload rule; and

provide an acknowledgment to the client upon obtaining said reporting.

849. A processor-implemented method, comprising:

identifying an unlicensed content item and uniquely resolving it within a universally resolvable media content ("URMC") service;

obtaining aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

obtaining an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

evaluating the obtained aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

identifying a target for a license request for the uniquely resolved content item; and

sending the license request to the identified target.

850. The method of claim 849, further comprising:

obtaining, from the target, a license authorizing addition of the uniquely resolved content item to the URMC catalog.

851. The method of claim 850, further comprising:

obtaining lossless original media file;

licensing, encrypting and encoding the obtained media file; and

making the encoded content media file available to users of the URMC service.

852. The method of claim 851, wherein the encoding includes a standard quality encoding and a mobile quality encoding.

853. The method of claim 849, wherein the license request includes at least the uniquely resolved content identifying information and a request to add the content item to the URMC collection.

854. The method of claim 849, wherein the URMC service user engagement metric is track play count.

855. The method of claim 849, wherein the URMC service user engagement metric is at least one of: (i) share count; (ii) download count; (iii) rating; and (iv) comment count.

856. The method of claim 855, wherein the URMC service user engagement metric is associated with at least one of: (i) a track; (ii) a playlist; (iii) a smart playlist; (iv) a shared playlist; (v) a magic playlist; and (vi) a shared library.

857. The method of claim 849, wherein the at least one URMC license request threshold rule specifies a trigger for the license request when the aggregate URMC service user engagement metric associated with the uniquely resolved content item is greater than a percent threshold of the aggregate URMC service user engagement metric associated with the plurality of URMC content items.

858. The method of claim 849, wherein the at least one URMC license request threshold rule specifies a threshold for the aggregate URMC service user engagement metrics associated with the uniquely resolved content item.

859. The method of claim 849, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises acoustically matching the content item with URMC items in a URMC catalog.

860. The method of claim 849, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises querying a URMC metadata database using metadata associated with the content item.

861. The method of claim 849, further comprising:

obtaining metadata associated with the uniquely resolved content item; and

querying a URMC license database using the obtained metadata for availability of license.

862. The method of claim 849, wherein the target for the license request is identified based on at least one of an acoustical fingerprint and metadata associated with the uniquely resolved content item.

863. The method of claim 849, wherein the identified target is a rights clearing agency.

864. The method of claim 849, wherein the identified target is one of participating licensors of the URMC service.

865. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

identify an unlicensed content item and uniquely resolving it within a universally resolvable media content ("URMC") service;

obtain aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

obtain an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

evaluate the obtained aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

identify a target for a license request for the uniquely resolved content item; and

send the license request to the identified target.

866. The system of claim 865, further comprising instructions to:

obtain, from the target, a license authorizing addition of the uniquely resolved content item to the URMC catalog.

867. The system of claim 866, further comprising instructions to:

obtain lossless original media file;

license, encrypting and encoding the obtained media file; and

make the encoded content media file available to users of the URMC service.

868. The system of claim 867, wherein the encoding includes a standard quality encoding and a mobile quality encoding.

869. The system of claim 865, wherein the license request includes at least the uniquely resolved content identifying information and a request to add the content item to the URMC collection.

870. The system of claim 865, wherein the URMC service user engagement metric is track play count.

871. The system of claim 865, wherein the URMC service user engagement metric is at least one of: (i) share count; (ii) download count; (iii) rating; and (iv) comment count.

872. The system of claim 871, wherein the URMC service user engagement metric is associated with at least one of: (i) a track; (ii) a playlist; (iii) a smart playlist; (iv) a shared playlist; (v) a magic playlist; and (vi) a shared library.

873. The system of claim 865, wherein the at least one URMC license request threshold rule specifies a trigger for the license request when the aggregate URMC service user engagement metric associated with the uniquely resolved content item is greater than a percent threshold of the aggregate URMC service user engagement metric associated with the plurality of URMC content items.

874. The system of claim 865, wherein the at least one URMC license request threshold rule specifies a threshold for the aggregate URMC service user engagement metrics associated with the uniquely resolved content item.

875. The system of claim 865, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises acoustically matching the content item with URMC items in a URMC catalog.

876. The system of claim 865, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises querying a URMC metadata database using metadata associated with the content item.

877. The system of claim 865, further comprising instructions to:

obtain metadata associated with the uniquely resolved content item; and

query a URMC license database using the obtained metadata for availability of license.

878. The system of claim 865, wherein the target for the license request is identified based on at least one of an acoustical fingerprint and metadata associated with the uniquely resolved content item.

879. The system of claim 865, wherein the identified target is a rights clearing agency.

880. The system of claim 865, wherein the identified target is one of participating licensors of the URMC service.

881. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

identify an unlicensed content item and uniquely resolving it within a universally resolvable media content ("URMC") service;

obtain aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

obtain an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

evaluate the obtained aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

identify a target for a license request for the uniquely resolved content item; and

send the license request to the identified target.

882. The medium of claim 881, further comprising instructions to:

obtain, from the target, a license authorizing addition of the uniquely resolved content item to the URMC catalog.

883. The medium of claim 882, further comprising instructions to:

obtain lossless original media file;

license, encrypting and encoding the obtained media file; and

make the encoded content media file available to users of the URMC service.

884. The medium of claim 883, wherein the encoding includes a standard quality encoding and a mobile quality encoding.

885. The medium of claim 881, wherein the license request includes at least the uniquely resolved content identifying information and a request to add the content item to the URMC collection.

886. The medium of claim 881, wherein the URMC service user engagement metric is track play count.

887. The medium of claim 881, wherein the URMC service user engagement metric is at least one of: (i) share count; (ii) download count; (iii) rating; and (iv) comment count.

888. The medium of claim 887, wherein the URMC service user engagement metric is associated with at least one of: (i) a track; (ii) a playlist; (iii) a smart playlist; (iv) a shared playlist; (v) a magic playlist; and (vi) a shared library.

889. The medium of claim 881, wherein the at least one URMC license request threshold rule specifies a trigger for the license request when the aggregate URMC service user engagement metric associated with the uniquely resolved content item is greater than a percent threshold of the aggregate URMC service user engagement metric associated with the plurality of URMC content items.

890. The medium of claim 881, wherein the at least one URMC license request threshold rule specifies a threshold for the aggregate URMC service user engagement metrics associated with the uniquely resolved content item.

891. The medium of claim 881, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises acoustically matching the content item with URMC items in a URMC catalog.

892. The medium of claim 881, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises querying a URMC metadata database using metadata associated with the content item.

893. The medium of claim 881, further comprising instructions to:

obtain metadata associated with the uniquely resolved content item; and

query a URMC license database using the obtained metadata for availability of license.

894. The medium of claim 881, wherein the target for the license request is identified based on at least one of an acoustical fingerprint and metadata associated with the uniquely resolved content item.

895. The medium of claim 881, wherein the identified target is a rights clearing agency.

896. The medium of claim 881, wherein the identified target is one of participating licensors of the URMC service.

897. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

identify an unlicensed content item and uniquely resolving it within a universally resolvable media content ("URMC") service;

obtain aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

obtain an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

evaluate the obtained aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

identify a target for a license request for the uniquely resolved content item; and

send the license request to the identified target.

898. The apparatus of claim 897, further comprising instructions to:

obtain, from the target, a license authorizing addition of the uniquely resolved content item to the URMC catalog.

899. The apparatus of claim 898, further comprising instructions to:

obtain lossless original media file;

license, encrypting and encoding the obtained media file; and

make the encoded content media file available to users of the URMC service.

900. The apparatus of claim 899, wherein the encoding includes a standard quality encoding and a mobile quality encoding.

901. The apparatus of claim 897, wherein the license request includes at least the uniquely resolved content identifying information and a request to add the content item to the URMC collection.

902. The apparatus of claim 897, wherein the URMC service user engagement metric is track play count.

903. The apparatus of claim 897, wherein the URMC service user engagement metric is at least one of: (i) share count; (ii) download count; (iii) rating; and (iv) comment count.

904. The apparatus of claim 903, wherein the URMC service user engagement metric is associated with at least one of: (i) a track; (ii) a playlist; (iii) a smart playlist; (iv) a shared playlist; (v) a magic playlist; and (vi) a shared library.

905. The apparatus of claim 897, wherein the at least one URMC license request threshold rule specifies a trigger for the license request when the aggregate URMC service user engagement metric associated with the uniquely resolved content item is greater than a percent threshold of the aggregate URMC service user engagement metric associated with the plurality of URMC content items.

906. The apparatus of claim 897, wherein the at least one URMC license request threshold rule specifies a threshold for the aggregate URMC service user engagement metrics associated with the uniquely resolved content item.

907. The apparatus of claim 897, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises acoustically matching the content item with URMC items in a URMC catalog.

908. The apparatus of claim 897, wherein identifying the unlicensed content item and uniquely resolving it within the URMC service further comprises querying a URMC metadata database using metadata associated with the content item.

909. The apparatus of claim 897, further comprising instructions to:

obtain metadata associated with the uniquely resolved content item; and

query a URMC license database using the obtained metadata for availability of license.

910. The apparatus of claim 897, wherein the target for the license request is identified based on at least one of an acoustical fingerprint and metadata associated with the uniquely resolved content item.

911. The apparatus of claim 897, wherein the identified target is a rights clearing agency.

912. The apparatus of claim 897, wherein the identified target is one of participating licensors of the URMC service.

913. A processor-implemented method, comprising:

providing an unlicensed content item for identification and uniquely resolving it within a universally resolvable media content ("URMC") service;

providing an indication to obtain aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

providing an indication to obtain an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

obtaining an indication of an evaluation of the aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

obtaining an identification of a target for a license request for the uniquely resolved content item; and

obtaining an indication of sending the license request to the identified target.

914. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

provide an unlicensed content item for identification and uniquely resolving it within a universally resolvable media content ("URMC") service;

provide an indication to obtain aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

provide an indication to obtain an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

obtain an indication of an evaluation of the aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

obtain an identification of a target for a license request for the uniquely resolved content item; and

obtain an indication of sending the license request to the identified target.

915. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

provide an unlicensed content item for identification and uniquely resolving it within a universally resolvable media content ("URMC") service;

provide an indication to obtain aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

provide an indication to obtain an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

obtain an indication of an evaluation of the aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

obtain an identification of a target for a license request for the uniquely resolved content item; and

obtain an indication of sending the license request to the identified target.

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916. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

provide an unlicensed content item for identification and uniquely resolving it within a universally resolvable media content ("URMC") service;

provide an indication to obtain aggregate URMC service user engagement metric associated with the uniquely resolved content item during a predefined period of time;

provide an indication to obtain an aggregate URMC service user engagement metric associated with a plurality of URMC items during the predefined period of time;

obtain an indication of an evaluation of the aggregate URMC service user engagement metrics using at least one URMC license request threshold rule;

obtain an identification of a target for a license request for the uniquely resolved content item; and

obtain an indication of sending the license request to the identified target.

917. A processor-implemented method, comprising:

detecting a plurality of universally resolvable media content ("URMC") events initiated at a client;

obtaining URMC event identifying information for each detected URMC event;

determining if each detected URMC event is reportable based on the URMC event identifying information;

determining a reporting category for each reportable URMC event based on the URMC event identifying information;

recording each reportable URMC event and the associated reporting category in an event log in the client; and

initiating reporting of the logged URMC event identifying information.

918. The method of claim 917, further comprising:

obtaining reporting frequency preference setting, wherein the preference setting includes at least one URMC event reporting rule; and

initiating reporting of the logged URMC event identifying information based on the obtained reporting frequency preference setting.

919. The method of claim 918, further comprising updating the client upon successful acknowledgement of said reporting by a server.

920. The method of claim 917, wherein reportable events include at least one of: (i) play session time; (ii) playlist feature use; (iii) importing; (iv)sharing; (v) community; (vi) search; (vii) website; (viii) client; (ix) email; (x) marketing; (xi) user; and (xii) license and device.

921. The method of claim 920, wherein each reportable event is associated with a URMC service user identifier and a date and time stamp.

922. The method of claim 921, wherein determining if each detected URMC event is reportable based on the URMC event identifying information.

923. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

detect a plurality of universally resolvable media content ("URMC") events initiated at a client;

obtain URMC event identifying information for each detected URMC event;

determine if each detected URMC event is reportable based on the URMC event identifying information;

determine a reporting category for each reportable URMC event based on the URMC event identifying information;

record each reportable URMC event and the associated reporting category in an event log in the client; and

initiate reporting of the logged URMC event identifying information.

924. The system of claim 923, further comprising:

obtain reporting frequency preference setting, wherein the preference setting includes at least one URMC event reporting rule; and

initiate reporting of the logged URMC event identifying information based on the obtained reporting frequency preference setting.

925. The system of claim 924, further comprising updating the client upon successful acknowledgement of said reporting by a server.

926. The system of claim 923, wherein reportable events include at least one of: (i) play session time; (ii) playlist feature use; (iii) importing; (iv)sharing; (v) community; (vi) search; (vii) website; (viii) client; (ix) email; (x) marketing; (xi) user; and (xii) license and device.

927. The system of claim 926, wherein each reportable event is associated with a URMC service user identifier and a date and time stamp.

928. The system of claim 927, wherein determining if each detected URMC event is reportable based on the URMC event identifying information.

929. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

detect a plurality of universally resolvable media content ("URMC") events initiated at a client;

obtain URMC event identifying information for each detected URMC event;

determine if each detected URMC event is reportable based on the URMC event identifying information;

determine a reporting category for each reportable URMC event based on the URMC event identifying information;

record each reportable URMC event and the associated reporting category in an event log in the client; and

initiate reporting of the logged URMC event identifying information.

930. The medium of claim 929, further comprising:

obtain reporting frequency preference setting, wherein the preference setting includes at least one URMC event reporting rule; and

initiate reporting of the logged URMC event identifying information based on the obtained reporting frequency preference setting.

931. The medium of claim 930, further comprising updating the client upon successful acknowledgement of said reporting by a server.

932. The medium of claim 929, wherein reportable events include at least one of: (i) play session time; (ii) playlist feature use; (iii) importing; (iv)sharing; (v) community; (vi) search; (vii) website; (viii) client; (ix) email; (x) marketing; (xi) user; and (xii) license and device.

933. The medium of claim 932, wherein each reportable event is associated with a URMC service user identifier and a date and time stamp.

934. The medium of claim 933, wherein determining if each detected URMC event is reportable based on the URMC event identifying information.

935. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

detect a plurality of universally resolvable media content ("URMC") events initiated at a client;

obtain URMC event identifying information for each detected URMC event;

determine if each detected URMC event is reportable based on the URMC event identifying information;

determine a reporting category for each reportable URMC event based on the URMC event identifying information;

record each reportable URMC event and the associated reporting category in an event log in the client; and

initiate reporting of the logged URMC event identifying information.

936. The apparatus of claim 935, further comprising:

obtain reporting frequency preference setting, wherein the preference setting includes at least one URMC event reporting rule; and

initiate reporting of the logged URMC event identifying information based on the obtained reporting frequency preference setting.

937. The apparatus of claim 936, further comprising updating the client upon successful acknowledgement of said reporting by a server.

938. The apparatus of claim 935, wherein reportable events include at least one of: (i) play session time; (ii) playlist feature use; (iii) importing; (iv)sharing; (v) community; (vi) search; (vii) website; (viii) client; (ix) email; (x) marketing; (xi) user; and (xii) license and device.

939. The apparatus of claim 938, wherein each reportable event is associated with a URMC service user identifier and a date and time stamp.

940. The apparatus of claim 939, wherein determining if each detected URMC event is reportable based on the URMC event identifying information.

941. A processor-implemented method, comprising:

providing a request to detect a plurality of universally resolvable media content ("URMC") events initiated at a client;

providing URMC event identifying information for each detected URMC event;

providing a request to determine if each detected URMC event is reportable based on the URMC event identifying information;

providing a request to determine a reporting category for each reportable URMC event based on the URMC event identifying information;

providing a request to record each reportable URMC event and the associated reporting category in an event log in the client; and

providing a request to initiate reporting of the logged URMC event identifying information.

942. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

provide a request to detect a plurality of universally resolvable media content ("URMC") events initiated at a client;

provide URMC event identifying information for each detected URMC event;

provide a request to determine if each detected URMC event is reportable based on the URMC event identifying information;

provide a request to determine a reporting category for each reportable URMC event based on the URMC event identifying information;

provide a request to record each reportable URMC event and the associated reporting category in an event log in the client; and

provide a request to initiate reporting of the logged URMC event identifying information.

943. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

provide a request to detect a plurality of universally resolvable media content ("URMC") events initiated at a client;

provide URMC event identifying information for each detected URMC event;

provide a request to determine if each detected URMC event is reportable based on the URMC event identifying information;

provide a request to determine a reporting category for each reportable URMC event based on the URMC event identifying information;

provide a request to record each reportable URMC event and the associated reporting category in an event log in the client; and

provide a request to initiate reporting of the logged URMC event identifying information.

944. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

provide a request to detect a plurality of universally resolvable media content ("URMC") events initiated at a client;

provide URMC event identifying information for each detected URMC event;

provide a request to determine if each detected URMC event is reportable based on the URMC event identifying information;

provide a request to determine a reporting category for each reportable URMC event based on the URMC event identifying information;

provide a request to record each reportable URMC event and the associated reporting category in an event log in the client; and

provide a request to initiate reporting of the logged URMC event identifying information.

945. A processor-implemented method, comprising:

receiving from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

querying a URMC usage database to obtain the URMC item usage metric;

determining, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

providing the determined payment amount to the requestor.

946. The method of claim 945, wherein the URMC usage payment obligation rules specify royalty rate for a unit of the usage metric.

947. The method of claim 946, wherein the royalty rate is specific to a geography.

948. The method of claim 945, wherein the payment amount is device license fees based on prorated share of the URMC item usage.

949. The method of claim 945, wherein the request specifies at least one criterion for selecting the URMC item.

950. The method of claim 945, further comprising querying a URMC reporting database using the specified criterion to obtain the URMC item.

951. The method of claim 945, wherein the URMC usage metric is play count.

952. The method of claim 945, wherein the URMC usage metric is number of license activations.

953. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

receive from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

query a URMC usage database to obtain the URMC item usage metric;

determine, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

provide the determined payment amount to the requestor.

954. The system of claim 953, wherein the URMC usage payment obligation rules specify royalty rate for a unit of the usage metric.

955. The system of claim 954, wherein the royalty rate is specific to a geography.

956. The system of claim 953, wherein the payment amount is device license fees based on prorated share of the URMC item usage.

957. The system of claim 953, wherein the request specifies at least one criterion for selecting the URMC item.

958. The system of claim 953, further comprising instructions to query a URMC reporting database using the specified criterion to obtain the URMC item.

959. The system of claim 953, wherein the URMC usage metric is play count.

960. The system of claim 953, wherein the URMC usage metric is number of license activations.

961. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

receive from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

query a URMC usage database to obtain the URMC item usage metric;

determine, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

provide the determined payment amount to the requestor.

962. The medium of claim 961, wherein the URMC usage payment obligation rules specify royalty rate for a unit of the usage metric.

963. The medium of claim 962, wherein the royalty rate is specific to a geography.

964. The medium of claim 961, wherein the payment amount is device license fees based on prorated share of the URMC item usage.

965. The medium of claim 961, wherein the request specifies at least one criterion for selecting the URMC item.

966. The medium of claim 961, further comprising instructions to query a URMC reporting database using the specified criterion to obtain the URMC item.

967. The medium of claim 961, wherein the URMC usage metric is play count.

968. The medium of claim 961, wherein the URMC usage metric is number of license activations.

969. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

receive from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

query a URMC usage database to obtain the URMC item usage metric;

determine, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

provide the determined payment amount to the requestor.

970. The apparatus of claim 969, wherein the URMC usage payment obligation rules specify royalty rate for a unit of the usage metric.

971. The apparatus of claim 970, wherein the royalty rate is specific to a geography.

972. The apparatus of claim 969, wherein the payment amount is device license fees based on prorated share of the URMC item usage.

973. The apparatus of claim 969, wherein the request specifies at least one criterion for selecting the URMC item.

974. The apparatus of claim 969, further comprising instructions to query a URMC reporting database using the specified criterion to obtain the URMC item.

975. The apparatus of claim 969, wherein the URMC usage metric is play count.

976. The apparatus of claim 969, wherein the URMC usage metric is number of license activations.

977. A processor-implemented method, comprising:

providing from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

providing a request to query a URMC usage database to obtain the URMC item usage metric;

providing a request to determine, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

obtaining the determined payment amount to the requestor.

978. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

provide from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

provide a request to query a URMC usage database to obtain the URMC item usage metric;

provide a request to determine, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

obtain the determined payment amount to the requestor.

979. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

provide from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

provide a request to query a URMC usage database to obtain the URMC item usage metric;

provide a request to determine, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

obtain the determined payment amount to the requestor.

980. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

provide from a requestor a payment request for usage of a universally resolvable media content ("URMC") item;

provide a request to query a URMC usage database to obtain the URMC item usage metric;

provide a request to determine, based on URMC usage payment obligation rules associated with the requestor and the URMC item usage metric, a payment amount owed for usage of the URMC item; and

obtain the determined payment amount to the requestor.

981. A processor-implemented method, comprising:

obtaining from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtaining the user's social influence metric in the service;

obtaining a purchase price associated with the URMC content item;

determining, based on the user's social influence metric, a discount;

providing the user an option to purchase the URMC content item at a purchase price reduced by the discount;

receiving from the user an indication and an authorization to purchase the URMC item;

charging an account associated with the user the purchase price reduced by the discount; and

providing the user a mechanism for unlocking the URMC item.

982. The method of claim 981, wherein the unlocking mechanism is a digital rights management (DRM) free version of the URMC item provided to the client.

983. The method of claim 981, wherein the unlocking mechanism is a decryption key configured to unlock the URMC item by the user's client software.

984. The method of claim 981, wherein the unlocked URMC item has no rights management restrictions.

985. The method of claim 981, wherein the unlocked URMC item has no encryption

986. The method of claim 981, wherein the social influence metric is a number of points associated with a social activity.

987. The method of claim 986, wherein the discount is triggered when the number of social activity points associated with the user exceeds a threshold.

988. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtain the user's social influence metric in the service;

obtain a purchase price associated with the URMC content item;

determine, based on the user's social influence metric, a discount;

provide the user an option to purchase the URMC content item at a purchase price reduced by the discount;

receive from the user an indication and an authorization to purchase the URMC item;

charge an account associated with the user the purchase price reduced by the discount; and

provide the user a mechanism for unlocking the URMC item.

989. The system of claim 988, wherein the unlocking mechanism is a digital rights management (DRM) free version of the URMC item provided to the client.

990. The system of claim 988, wherein the unlocking mechanism is a decryption key configured to unlock the URMC item by the user's client software.

991. The system of claim 988, wherein the unlocked URMC item has no rights management restrictions.

992. The system of claim 988, wherein the unlocked URMC item has no encryption

993. The system of claim 988, wherein the social influence metric is a number of points associated with a social activity.

994. The system of claim 993, wherein the discount is triggered when the number of social activity points associated with the user exceeds a threshold.

995. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

obtain from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtain the user's social influence metric in the service;

obtain a purchase price associated with the URMC content item;

determine, based on the user's social influence metric, a discount;

provide the user an option to purchase the URMC content item at a purchase price reduced by the discount;

receive from the user an indication and an authorization to purchase the URMC item;

charge an account associated with the user the purchase price reduced by the discount; and

provide the user a mechanism for unlocking the URMC item.

996. The medium of claim 995, wherein the unlocking mechanism is a digital rights management (DRM) free version of the URMC item provided to the client.

997. The medium of claim 995, wherein the unlocking mechanism is a decryption key configured to unlock the URMC item by the user's client software.

998. The medium of claim 995, wherein the unlocked URMC item has no rights management restrictions.

999. The medium of claim 995, wherein the unlocked URMC item has no encryption

1000. The medium of claim 995, wherein the social influence metric is a number of points associated with a social activity.

1001. The medium of claim 1000, wherein the discount is triggered when the number of social activity points associated with the user exceeds a threshold.

1002. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtain the user's social influence metric in the service;

obtain a purchase price associated with the URMC content item;

determine, based on the user's social influence metric, a discount;

provide the user an option to purchase the URMC content item at a purchase price reduced by the discount;

receive from the user an indication and an authorization to purchase the URMC item;

charge an account associated with the user the purchase price reduced by the discount; and

provide the user a mechanism for unlocking the URMC item.

1003. The apparatus of claim 1002, wherein the unlocking mechanism is a digital rights management (DRM) free version of the URMC item provided to the client.

1004. The apparatus of claim 1002, wherein the unlocking mechanism is a decryption key configured to unlock the URMC item by the user's client software.

1005. The apparatus of claim 1002, wherein the unlocked URMC item has no rights management restrictions.

1006. The apparatus of claim 1002, wherein the unlocked URMC item has no encryption

1007. The apparatus of claim 1002, wherein the social influence metric is a number of points associated with a social activity.

1008. The apparatus of claim 1007, wherein the discount is triggered when the number of social activity points associated with the user exceeds a threshold.

1009. A processor-implemented method, comprising:

obtaining a request to purchase an encryption free universally resolvable media content ("URMC") item from a user of the URMC service;

obtaining a purchase price associated with the content item;

determining whether the user meets a discount criteria for purchasing the encryption free content item;

calculating, based on the determining, a discounted purchase price;

providing the user an option to purchase the encryption free content item at the discounted purchase price;

receiving from the user an indication and an authorization to purchase the encryption free content item;

charging an account associated with the user the discounted purchase price; and

providing the user the encryption free content item.

1010. The method of claim 1009, wherein the discount criteria includes reaching a threshold number of points via influencing activity.

1011. The method of claim 1009, wherein the discount criteria includes having the content item in a playlist created by the user.

1012. The method of claim 1011, wherein the purchase price is progressively discounted by an amount for every degree of separation users that add the content.

1013. The method of claim 1009, wherein the discount criteria includes reaching a threshold number of plays of the content item discovered via the user's playlist or library.

1014. The method of claim 1009, wherein the discount criteria includes reaching a threshold number of users playing the content item discovered via the user's playlist or library.

1015. The method of claim 1009, wherein the discount criteria includes reaching a threshold number of encryption free purchases of content item.

1016. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain a request to purchase an encryption free universally resolvable media content ("URMC") item from a user of the URMC service;

obtain a purchase price associated with the content item;

determine whether the user meets a discount criteria for purchasing the encryption free content item;

calculate, based on the determining, a discounted purchase price;

provide the user an option to purchase the encryption free content item at the discounted purchase price;

receive from the user an indication and an authorization to purchase the encryption free content item;

charge an account associated with the user the discounted purchase price; and

provide the user the encryption free content item.

1017. The system of claim 1016, wherein the discount criteria includes reaching a threshold number of points via influencing activity.

1018. The system of claim 1016, wherein the discount criteria includes having the content item in a playlist created by the user.

1019. The system of claim 1018, wherein the purchase price is progressively discounted by an amount for every degree of separation users that add the content.

1020. The system of claim 1016, wherein the discount criteria includes reaching a threshold number of plays of the content item discovered via the user's playlist or library.

1021. The system of claim 1016, wherein the discount criteria includes reaching a threshold number of users playing the content item discovered via the user's playlist or library.

1022. The system of claim 1016, wherein the discount criteria includes reaching a threshold number of encryption free purchases of content item.

1023. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

obtain a request to purchase an encryption free universally resolvable media content ("URMC") item from a user of the URMC service;

obtain a purchase price associated with the content item;

determine whether the user meets a discount criteria for purchasing the encryption free content item;

calculate, based on the determining, a discounted purchase price;

provide the user an option to purchase the encryption free content item at the discounted purchase price;

receive from the user an indication and an authorization to purchase the encryption free content item;

charge an account associated with the user the discounted purchase price; and

provide the user the encryption free content item.

1024. The medium of claim 1023, wherein the discount criteria includes reaching a threshold number of points via influencing activity.

1025. The medium of claim 1023, wherein the discount criteria includes having the content item in a playlist created by the user.

1026. The medium of claim 1025, wherein the purchase price is progressively discounted by an amount for every degree of separation users that add the content.

1027. The medium of claim 1023, wherein the discount criteria includes reaching a threshold number of plays of the content item discovered via the user's playlist or library.

1028. The medium of claim 1023, wherein the discount criteria includes reaching a threshold number of users playing the content item discovered via the user's playlist or library.

1029. The medium of claim 1023, wherein the discount criteria includes reaching a threshold number of encryption free purchases of content item.

1030. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain a request to purchase an encryption free universally resolvable media content ("URMC") item from a user of the URMC service;

obtain a purchase price associated with the content item;

determine whether the user meets a discount criteria for purchasing the encryption free content item;

calculate, based on the determining, a discounted purchase price;

provide the user an option to purchase the encryption free content item at the discounted purchase price;

receive from the user an indication and an authorization to purchase the encryption free content item;

charge an account associated with the user the discounted purchase price; and

provide the user the encryption free content item.

1031. The apparatus of claim 1030, wherein the discount criteria includes reaching a threshold number of points via influencing activity.

1032. The apparatus of claim 1030, wherein the discount criteria includes having the content item in a playlist created by the user.

1033. The apparatus of claim 1032, wherein the purchase price is progressively discounted by an amount for every degree of separation users that add the content.

1034. The apparatus of claim 1030, wherein the discount criteria includes reaching a threshold number of plays of the content item discovered via the user's playlist or library.

1035. The apparatus of claim 1030, wherein the discount criteria includes reaching a threshold number of users playing the content item discovered via the user's playlist or library.

1036. The apparatus of claim 1030, wherein the discount criteria includes reaching a threshold number of encryption free purchases of content item.

1037. A processor-implemented method, comprising:

obtaining from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtaining a purchase price associated with the URMC item;

providing the user an option to purchase the URMC item at a purchase price;

receiving from the user an indication and an authorization to purchase the URMC item;

charging an account associated with the user the purchase price; and

providing the user a mechanism for unlocking the URMC item.

1038. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtain a purchase price associated with the URMC item;

provide the user an option to purchase the URMC item at a purchase price;

receive from the user an indication and an authorization to purchase the URMC item;

charge an account associated with the user the purchase price; and

provide the user a mechanism for unlocking the URMC item.

1039. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

obtain from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtain a purchase price associated with the URMC item;

provide the user an option to purchase the URMC item at a purchase price;

receive from the user an indication and an authorization to purchase the URMC item;

charge an account associated with the user the purchase price; and

provide the user a mechanism for unlocking the URMC item.

1040. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain from a user of a universally resolvable media content ("URMC") service a request to purchase an unlocked URMC item;

obtain a purchase price associated with the URMC item;

provide the user an option to purchase the URMC item at a purchase price;

receive from the user an indication and an authorization to purchase the URMC item;

charge an account associated with the user the purchase price; and

provide the user a mechanism for unlocking the URMC item.

1041. A processor implemented method comprising:

detecting a request to engage a universally resolvable media content ("URMC") item;

obtaining an expiration date for a URMC license token associated with the URMC item;

determining, based on the obtained expiration date, whether the license token is expired;

discarding a license key associated with the expired license token;

denying the request to engage the URMC item with the associated expired license token;

providing a request for an updated token and requisite credentials for the updated token;

obtaining a response including an updated token; and

engaging the requested URMC item with an associated valid updated token.

1042. The method of claim 1041, wherein the response includes a user node identifier and at least one subscription node identifier.

1043. The method of claim 1042, wherein the response includes the user node to the at least one subscription node link.

1044. The method of claim 1043, wherein the subscription node specifies a territory where a user's device is licensed for use.

1045. The method of claim 1043, wherein the subscription node specifies a territory where the URMC item is licensed for use.

1046. The method of claim 1041, wherein the response includes a user to device link having an associated expiration date.

1047. The method of claim 1043, further comprising retrieving a key for territory specified by the subscription node for decrypting encryption for engaging the URMC item.

1048. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

detect a request to engage a universally resolvable media content ("URMC") item;

obtain an expiration date for a URMC license token associated with the URMC item;

determine, based on the obtained expiration date, whether the license token is expired;

discard a license key associated with the expired license token;

deny the request to engage the URMC item with the associated expired license token;

provide a request for an updated token and requisite credentials for the updated token;

obtain a response including an updated token; and

engage the requested URMC item with an associated valid updated token.

1049. The system of claim 1048, wherein the response includes a user node identifier and at least one subscription node identifier.

1050. The system of claim 1049, wherein the response includes the user node to the at least one subscription node link.

1051. The system of claim 1050, wherein the subscription node specifies a territory where a user's device is licensed for use.

1052. The system of claim 1050, wherein the subscription node specifies a territory where the URMC item is licensed for use.

1053. The system of claim 1048, wherein the response includes a user to device link having an associated expiration date.

1054. The system of claim 1050, further comprising instructions to retrieve a key for territory specified by the subscription node for decrypting encryption for engaging the URMC item.

1055. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

detect a request to engage a universally resolvable media content ("URMC") item;

obtain an expiration date for a URMC license token associated with the URMC item;

determine, based on the obtained expiration date, whether the license token is expired;

discard a license key associated with the expired license token;

deny the request to engage the URMC item with the associated expired license token;

provide a request for an updated token and requisite credentials for the updated token;

obtain a response including an updated token; and

engage the requested URMC item with an associated valid updated token.

1056. The medium of claim 1055, wherein the response includes a user node identifier and at least one subscription node identifier.

1057. The medium of claim 1056, wherein the response includes the user node to the at least one subscription node link.

1058. The medium of claim 1057, wherein the subscription node specifies a territory where a user's device is licensed for use.

1059. The medium of claim 1057, wherein the subscription node specifies a territory where the URMC item is licensed for use.

1060. The medium of claim 1055, wherein the response includes a user to device link having an associated expiration date.

1061. The medium of claim 1057, further comprising instructions to retrieve a key for territory specified by the subscription node for decrypting encryption for engaging the URMC item.

1062. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

detect a request to engage a universally resolvable media content ("URMC") item;

obtain an expiration date for a URMC license token associated with the URMC item;

determine, based on the obtained expiration date, whether the license token is expired;

discard a license key associated with the expired license token;

deny the request to engage the URMC item with the associated expired license token;

provide a request for an updated token and requisite credentials for the updated token;

obtain a response including an updated token; and

engage the requested URMC item with an associated valid updated token.

1063. The apparatus of claim 1062, wherein the response includes a user node identifier and at least one subscription node identifier.

1064. The apparatus of claim 1063, wherein the response includes the user node to the at least one subscription node link.

1065. The apparatus of claim 1064, wherein the subscription node specifies a territory where a user's device is licensed for use.

1066. The apparatus of claim 1064, wherein the subscription node specifies a territory where the URMC item is licensed for use.

1067. The apparatus of claim 1062, wherein the response includes a user to device link having an associated expiration date.

1068. The apparatus of claim 1064, further comprising instructions to retrieve a key for territory specified by the subscription node for decrypting encryption for engaging the URMC item.

1069. A processor-implemented method, comprising:

obtaining a request for a license token for decrypting a universally resolvable media content ("URMC") item for a user of the URMC service;

determining whether an issued link between the user and at least one device associated with the request is valid;

obtaining confirmation of at least one instance of content usage reporting for the issued link from the device;

determining, based on the valid issued link and the obtained confirmation, an expiration date for a new link;

generating and sending the requested license token for the new link to the device; and

issuing and sending the new link to the device.

1070. A system, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain a request for a license token for decrypting a universally resolvable media content ("URMC") item for a user of the URMC service;

determine whether an issued link between the user and at least one device associated with the request is valid;

obtain confirmation of at least one instance of content usage reporting for the issued link from the device;

determine, based on the valid issued link and the obtained confirmation, an expiration date for a new link;

generate and send the requested license token for the new link to the device; and

issue and send the new link to the device.

1071. A processor-readable medium storing processor-issuable instructions, wherein the processor issues instructions to:

obtain a request for a license token for decrypting a universally resolvable media content ("URMC") item for a user of the URMC service;

determine whether an issued link between the user and at least one device associated with the request is valid;

obtain confirmation of at least one instance of content usage reporting for the issued link from the device;

determine, based on the valid issued link and the obtained confirmation, an expiration date for a new link;

generate and send the requested license token for the new link to the device; and

issue and send the new link to the device.

1072. An apparatus, comprising:

a memory;

a processor disposed in communication with said memory, and configured to issue a plurality of processing instructions stored in the memory, wherein the processor issues instructions to:

obtain a request for a license token for decrypting a universally resolvable media content ("URMC") item for a user of the URMC service;

determine whether an issued link between the user and at least one device associated with the request is valid;

obtain confirmation of at least one instance of content usage reporting for the issued link from the device;

determine, based on the valid issued link and the obtained confirmation, an expiration date for a new link;

generate and send the requested license token for the new link to the device; and

issue and send the new link to the device.

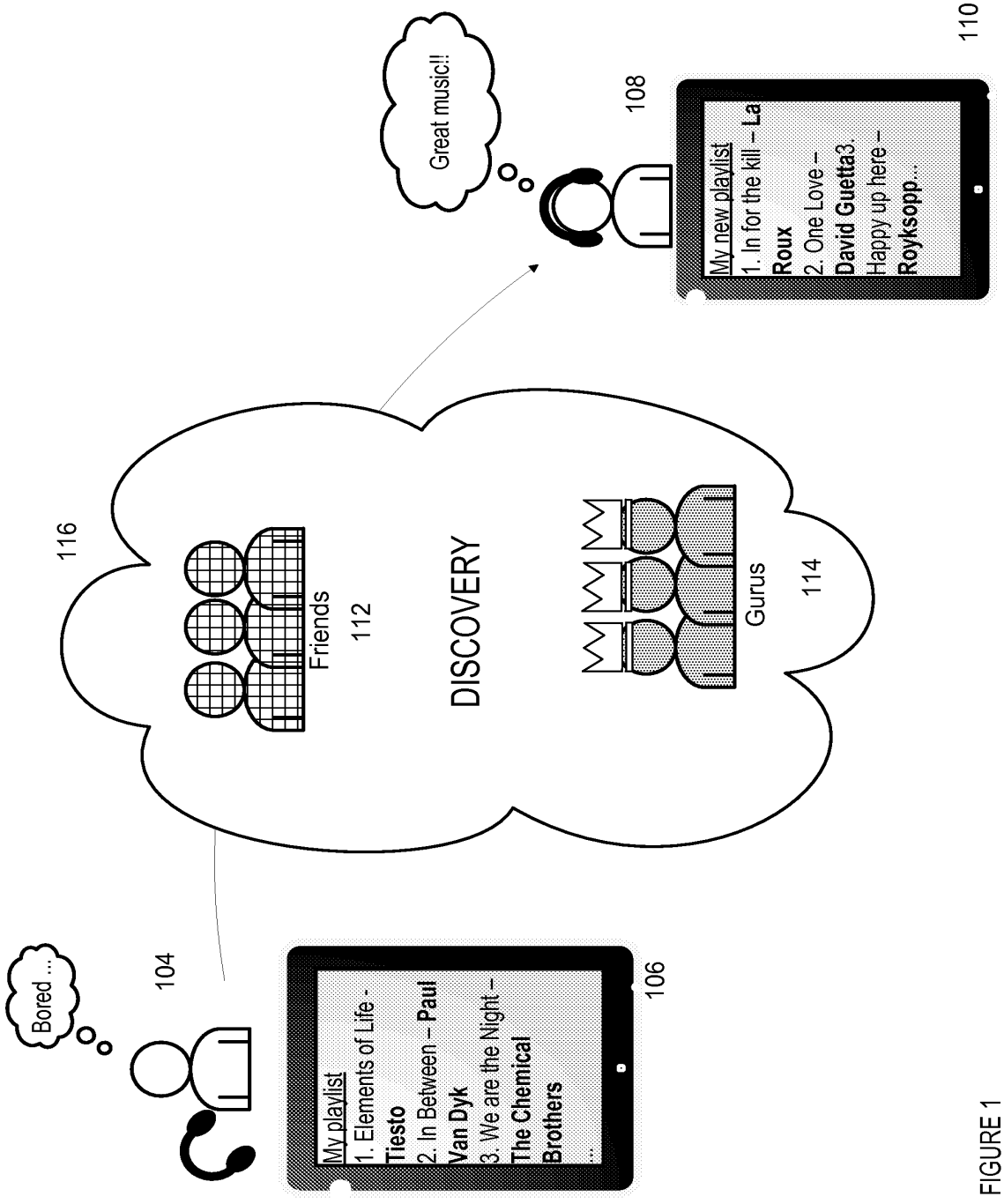

Bored ...
104
My playlist
1. Elements of Life - Tiesto
2. In Between – Paul Van Dyk
3. We are the Night – The Chemical Brothers
...
106
116
Friends
112
DISCOVERY
Gurus
114
Great music!!
108
My new playlist
1. In for the kill – La Roux
2. One Love – David Guetta3. Happy up here – Royksopp...
110

FIGURE 1

200
Kmen's Library
1. Junior – Royksopp
2. Go – Moby
3. The Fat of the Land
...
JJ's Library
1. Discovery – Daft Punk
2. Electric Love – Dirty Vegas
3. Distant Earth – ATB
...
PK's Library
1. La Roux – La Roux
2. Dirty Vegas – Dirty Vegas
3. One Love – David Guetta
...
GURUS 202
Magic Playlist
1. In for the kill
2. Love is gone
3. Le disko
4. Happy up here
...
MAGIC PLAYLIST GENERATION 204
DEEP/MOLECULAR DISCOVERY (e.g., visually navigating through related content) 206
SHARED DISCOVERY (e.g., visually navigating through shared content) 208
RELATED CONTENT (e.g., artists, albums, tracks, playlists, Gurus, etc., related to a content item) 216
SEARCH (e.g., artist name, track name, Guru name, playlist name, etc.) 210
INFINITE LIBRARY HOME (e.g., home page with charts, mixes, top artists, albums, etc.) 214
SPOTLIGHT SEARCH (e.g., artist name, track name, Guru name, playlist name, etc.) 212

FIGURE 2

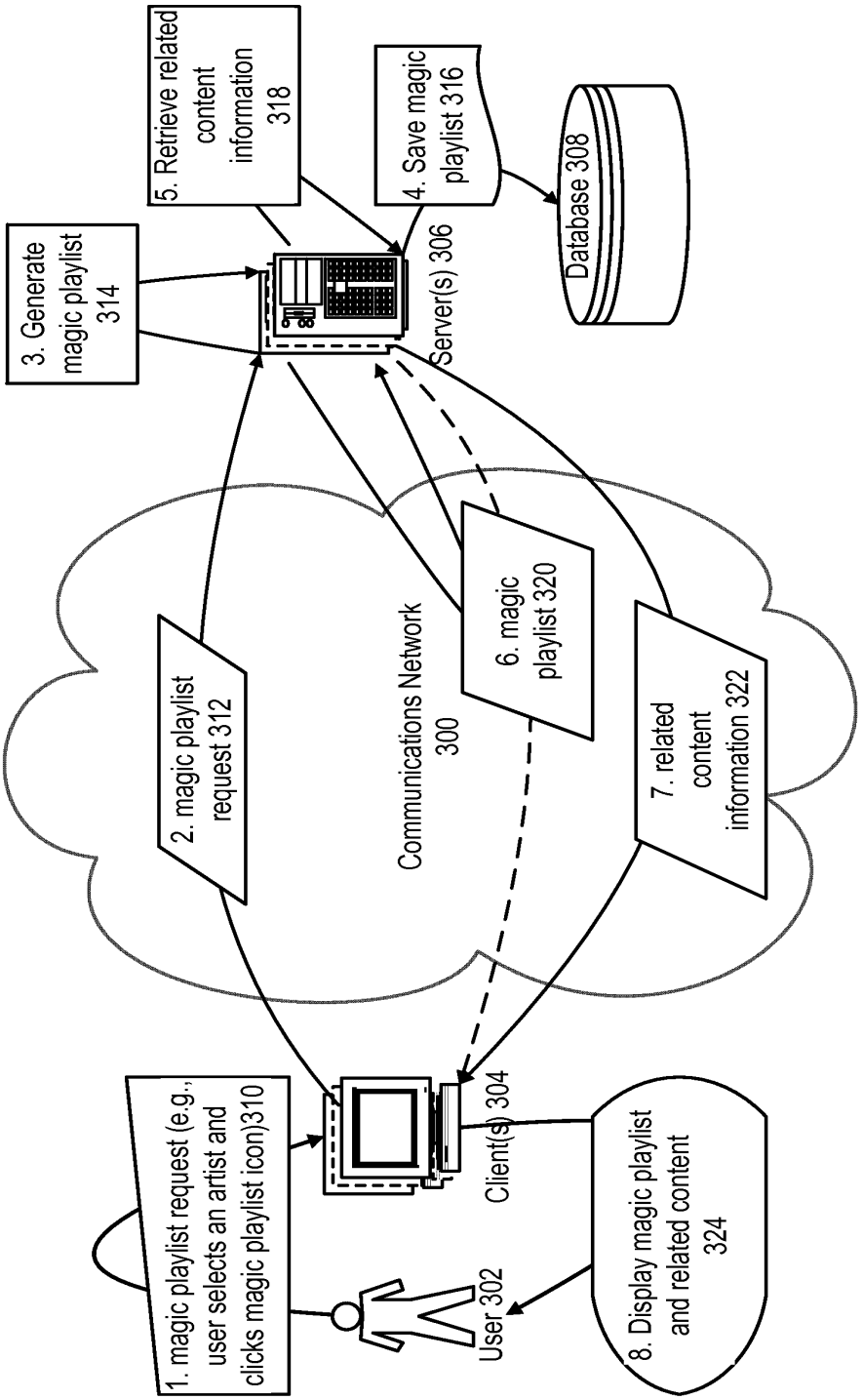

1. magic playlist request (e.g., user selects an artist and clicks magic playlist icon)310
User 302
Client(s) 304
2. magic playlist request 312
3. Generate magic playlist 314
Server(s) 306
4. Save magic playlist 316
5. Retrieve related content information 318
Database 308
Communications Network 300
6. magic playlist 320
7. related content information 322
8. Display magic playlist and related content 324

FIGURE 3

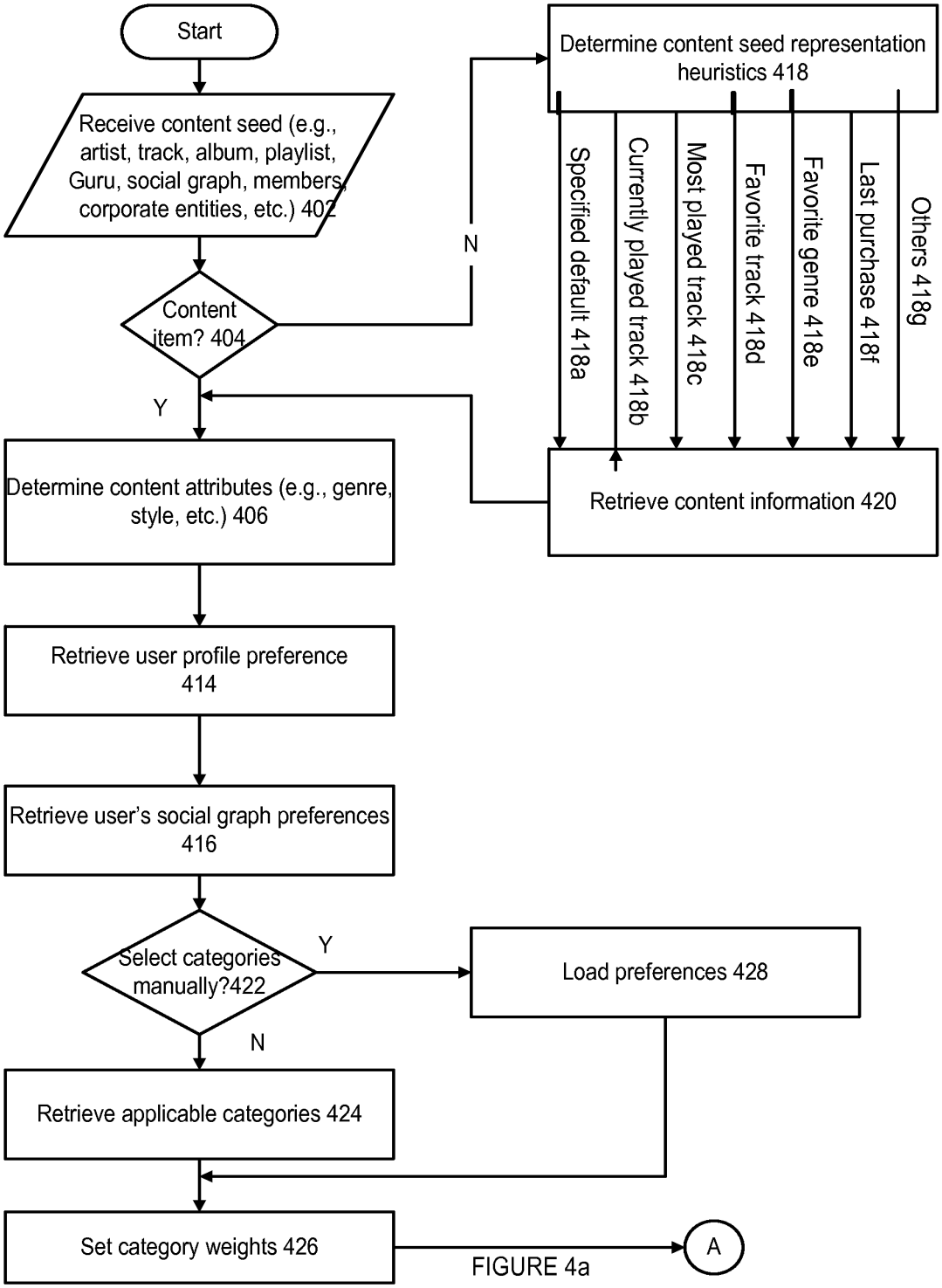

Start
Receive content seed (e.g., artist, track, album, playlist, Guru, social graph, members, corporate entities, etc.) 402
Content item? 404
N
Y
Determine content seed representation heuristics 418
Specified default 418a
Currently played track 418b
Most played track 418c
Favorite track 418d
Favorite genre 418e
Last purchase 418f
Others 418g
Retrieve content information 420
Determine content attributes (e.g., genre, style, etc.) 406
Retrieve user profile preference 414
Retrieve user's social graph preferences 416
Select categories manually?422
Y
N
Load preferences 428
Retrieve applicable categories 424
Set category weights 426
A

FIGURE 4a

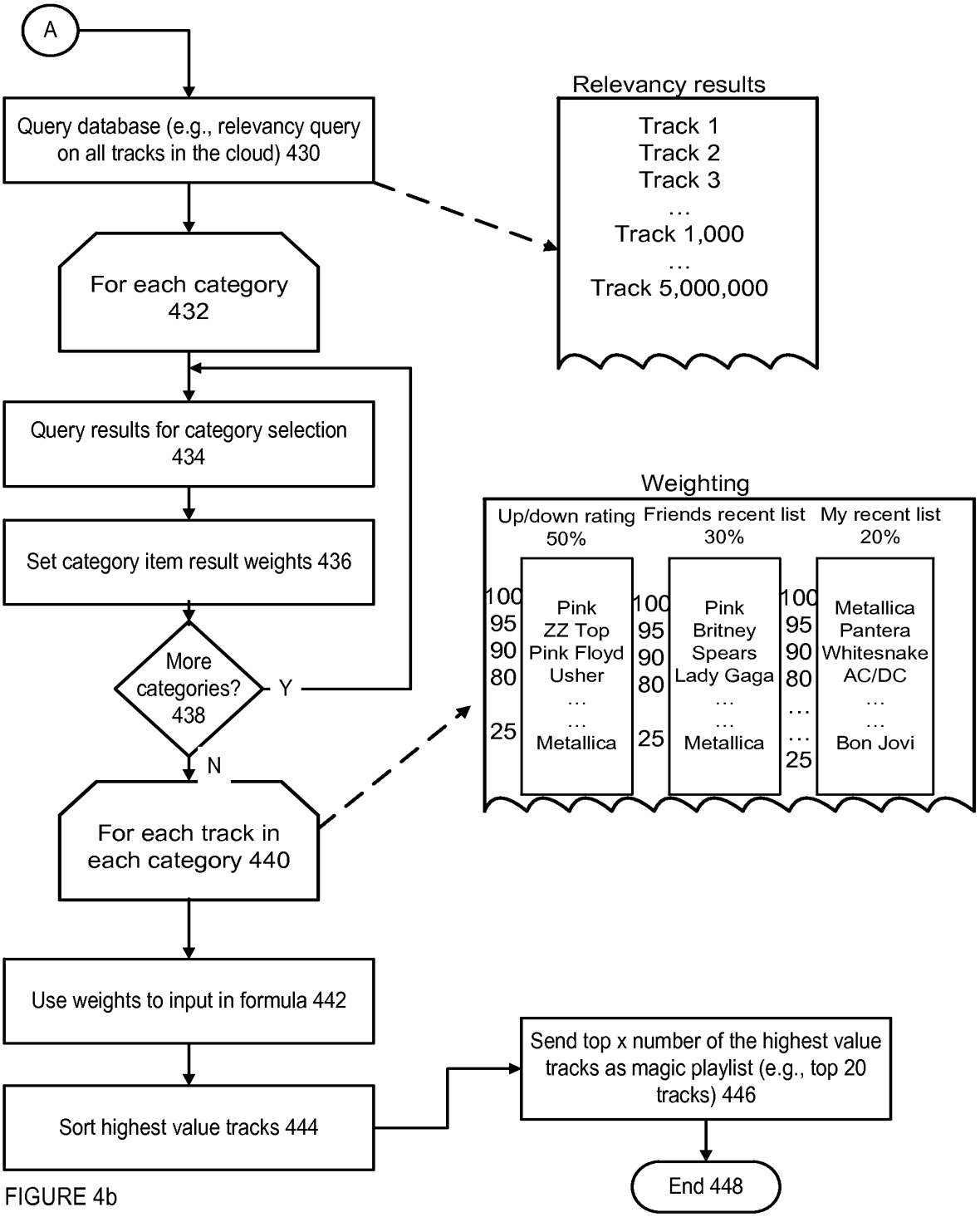

A
Query database (e.g., relevancy query on all tracks in the cloud) 430
Relevancy results
Track 1
Track 2
Track 3
…
Track 1,000
…
Track 5,000,000
For each category 432
Query results for category selection 434
Set category item result weights 436
Weighting
Up/down rating 50%
Friends recent list 30%
My recent list 20%
100
95
90
80
25
Pink
ZZ Top
Pink Floyd
Usher
…
Metallica
Pink
Britney Spears
Lady Gaga
…
Metallica
Metallica
Pantera
Whitesnake
AC/DC
…
Bon Jovi
More categories? 438
Y
N
For each track in each category 440
Use weights to input in formula 442
Sort highest value tracks 444
Send top x number of the highest value tracks as magic playlist (e.g., top 20 tracks) 446
End 448

FIGURE 4b

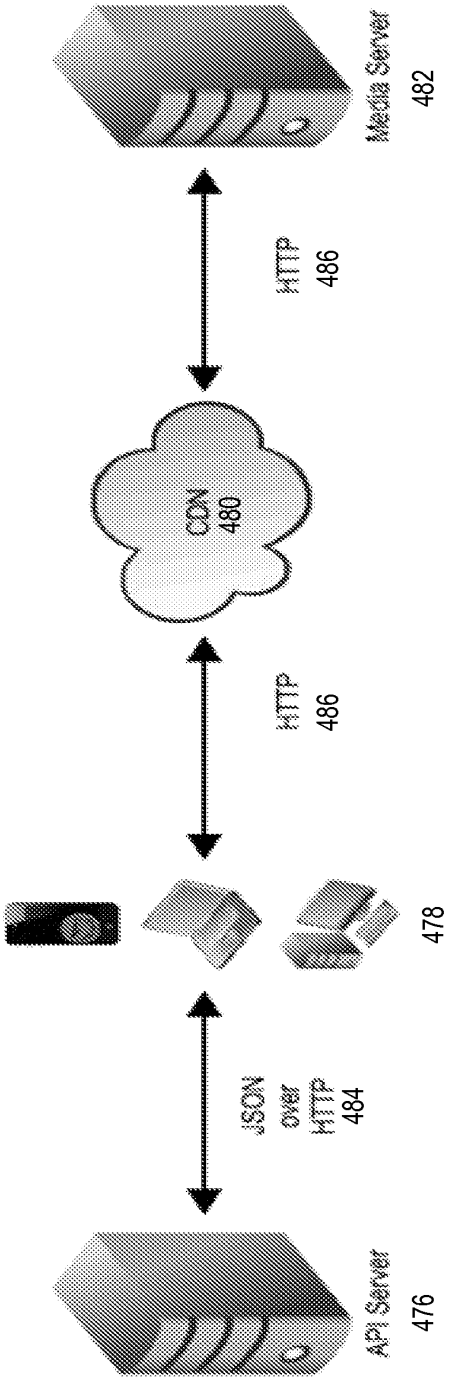

Media Server
482
HTTP
486
CDN
480
HTTP
486
478
JSON
over
HTTP
484
API Server
476

FIGURE 4c

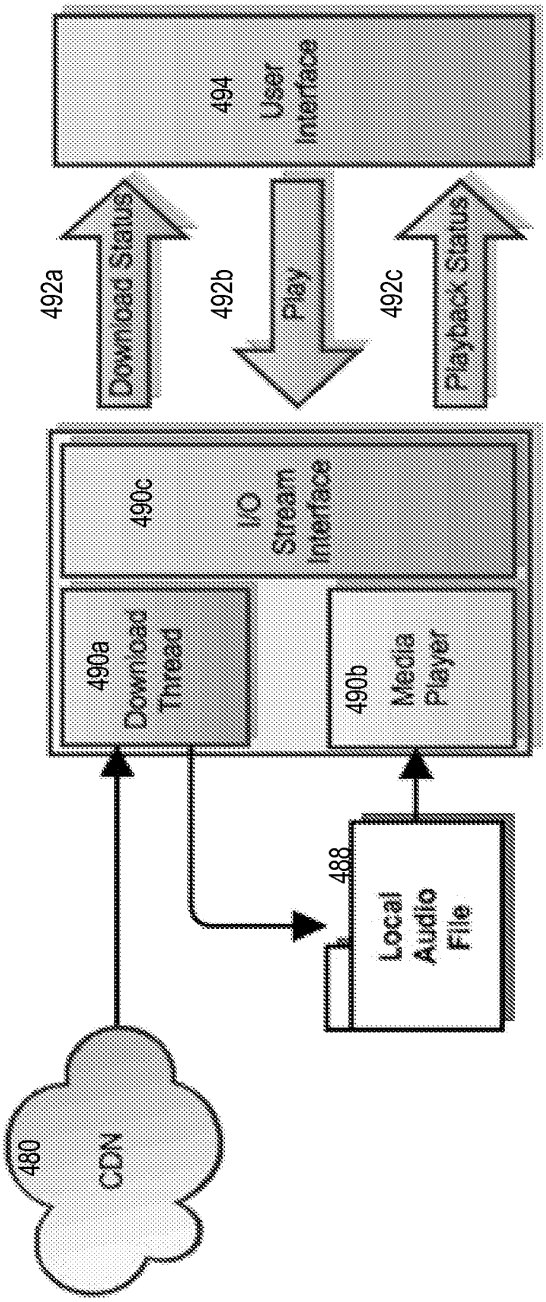

494
User Interface
492a
Download Status
492b
Play
492c
Playback Status
490c
I/O Stream Interface
490a
Download Thread
490b
Media Player
488
Local Audio File
480
CDN

FIGURE 4d

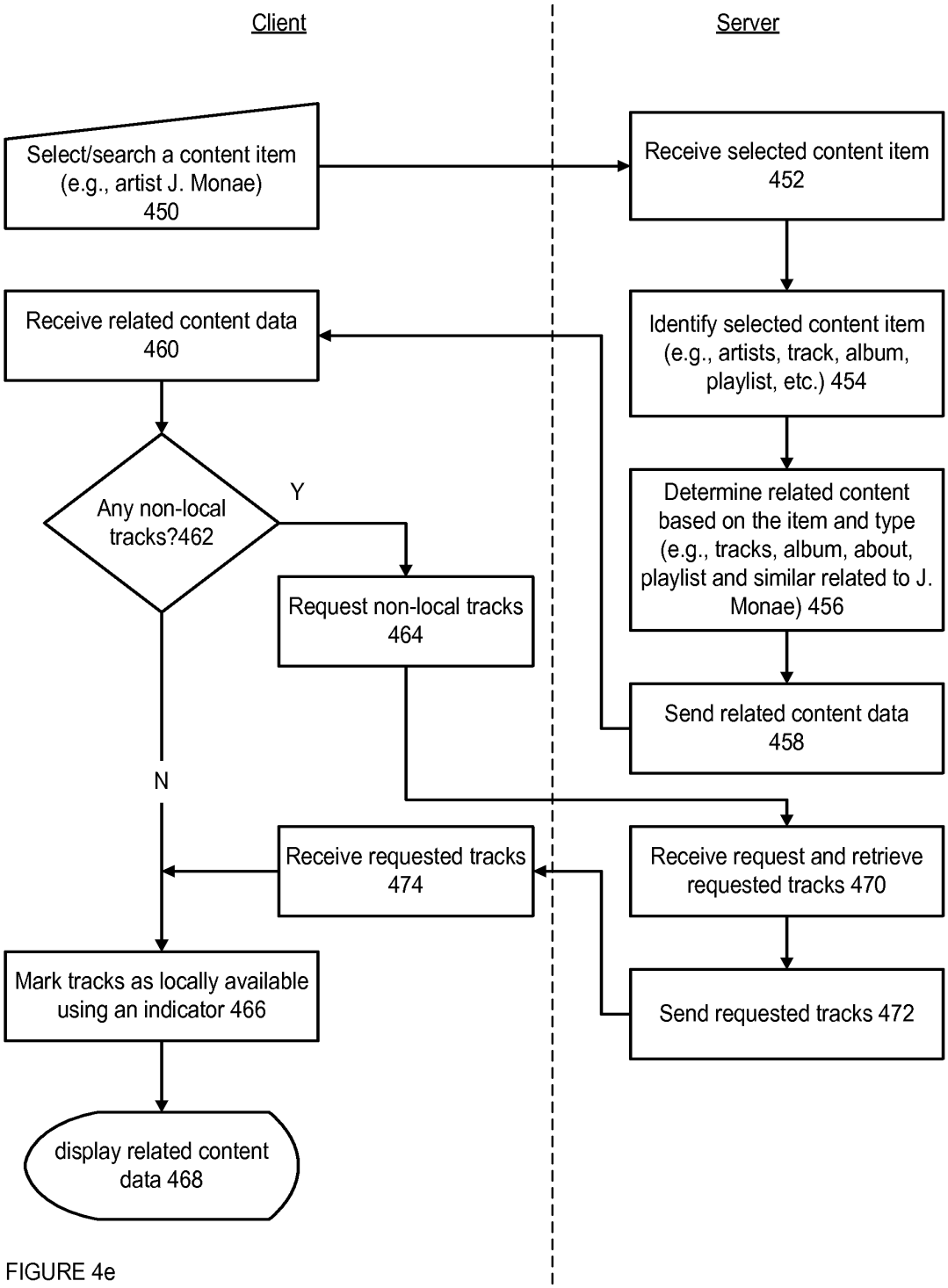

Client
Server
Select/search a content item (e.g., artist J. Monae) 450
Receive selected content item 452
Receive related content data 460
Identify selected content item (e.g., artists, track, album, playlist, etc.) 454
Any non-local tracks?462
Y
Determine related content based on the item and type (e.g., tracks, album, about, playlist and similar related to J. Monae) 456
Request non-local tracks 464
Send related content data 458
N
Receive requested tracks 474
Receive request and retrieve requested tracks 470
Mark tracks as locally available using an indicator 466
Send requested tracks 472
display related content data 468

FIGURE 4e

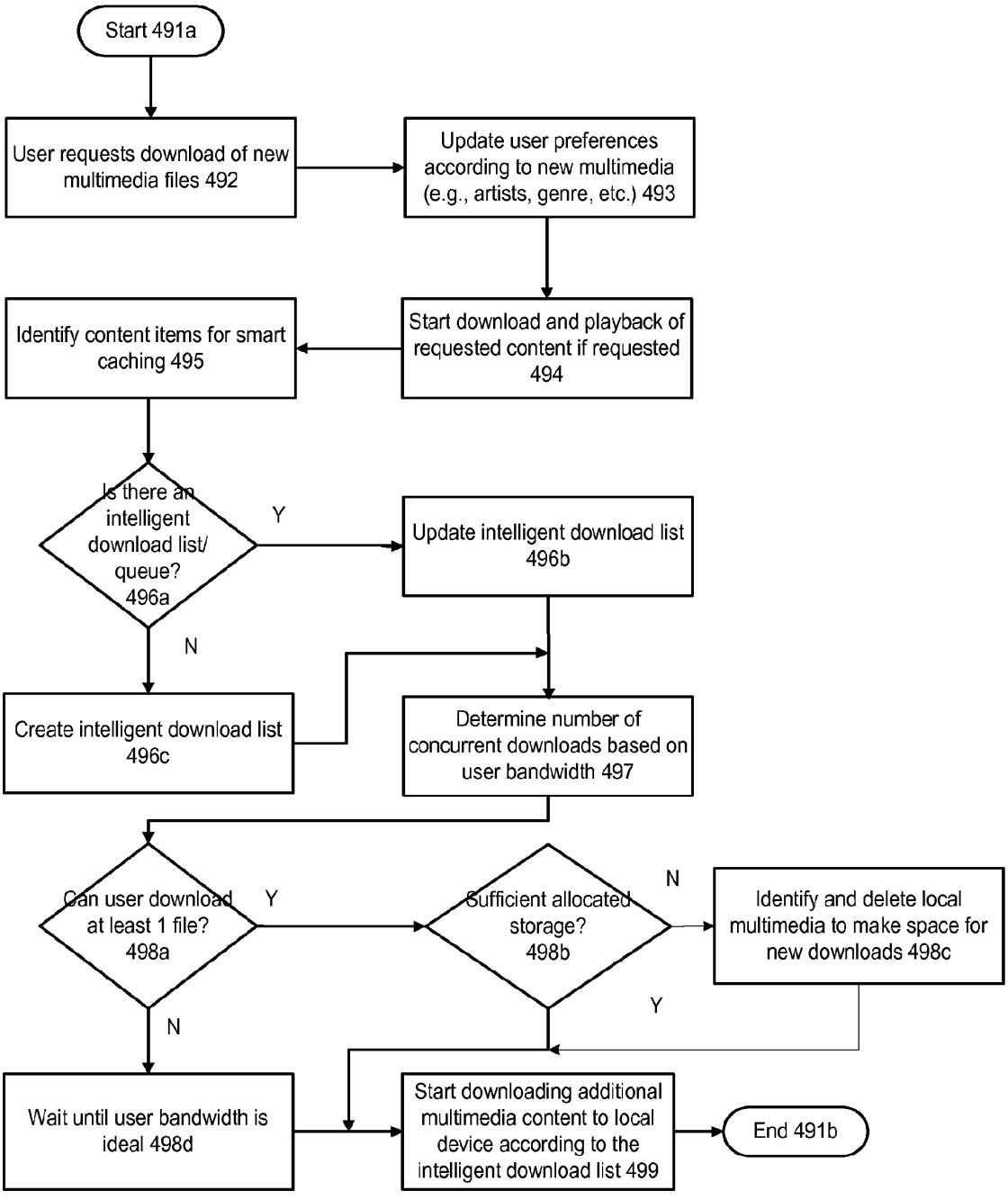

Start 491a
User requests download of new multimedia files 492
Update user preferences according to new multimedia (e.g., artists, genre, etc.) 493
Start download and playback of requested content if requested 494
Identify content items for smart caching 495
Is there an intelligent download list/ queue? 496a
Y
Update intelligent download list 496b
N
Create intelligent download list 496c
Determine number of concurrent downloads based on user bandwidth 497
Can user download at least 1 file? 498a
Y
Sufficient allocated storage? 498b
N
Identify and delete local multimedia to make space for new downloads 498c
Y
N
Wait until user bandwidth is ideal 498d
Start downloading additional multimedia content to local device according to the intelligent download list 499
End 491b

FIGURE 4f

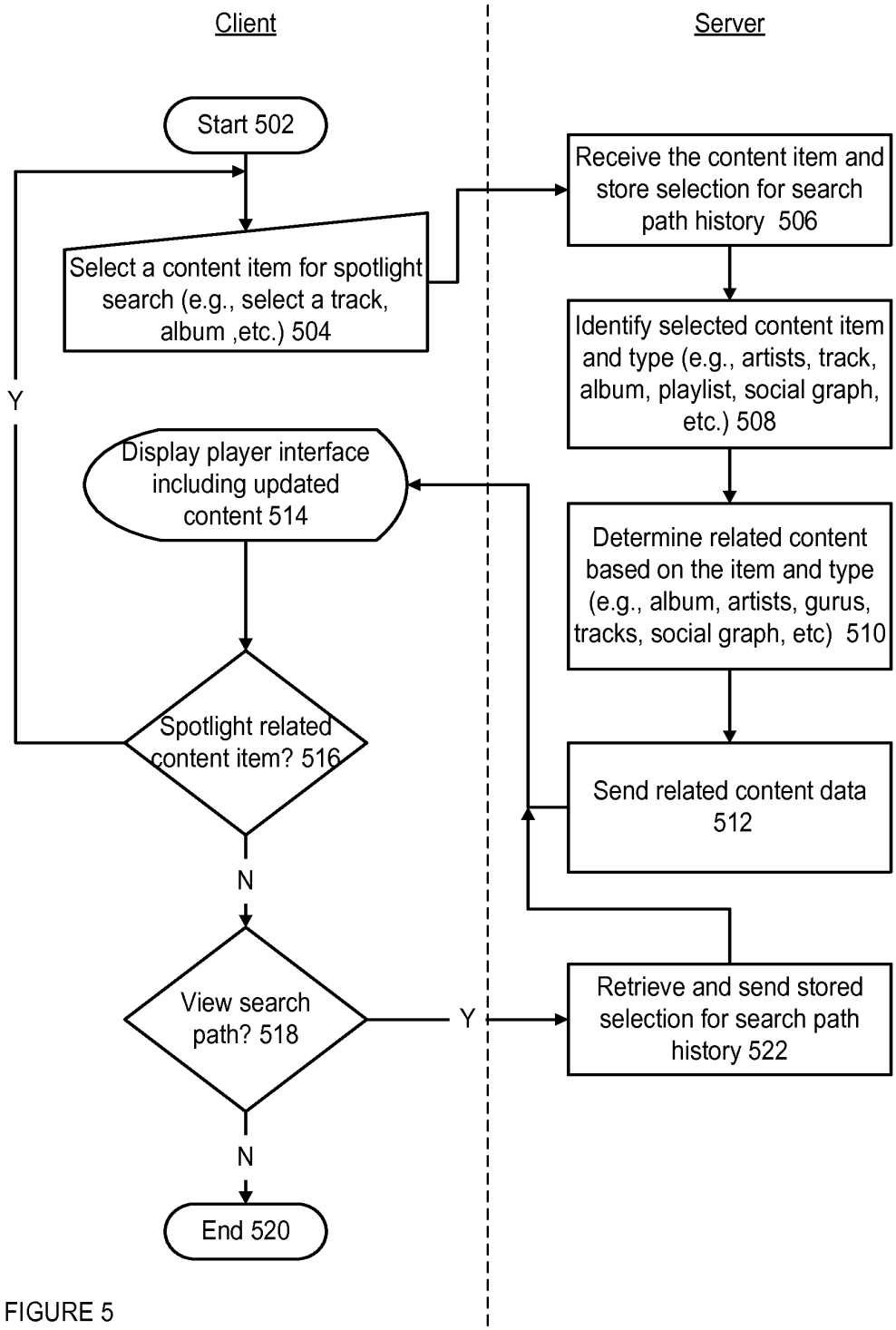

Client
Server
Start 502
Select a content item for spotlight search (e.g., select a track, album ,etc.) 504
Receive the content item and store selection for search path history 506
Identify selected content item and type (e.g., artists, track, album, playlist, social graph, etc.) 508
Determine related content based on the item and type (e.g., album, artists, gurus, tracks, social graph, etc) 510
Send related content data 512
Display player interface including updated content 514
Spotlight related content item? 516
Y
N
View search path? 518
Y
Retrieve and send stored selection for search path history 522
N
End 520

FIGURE 5

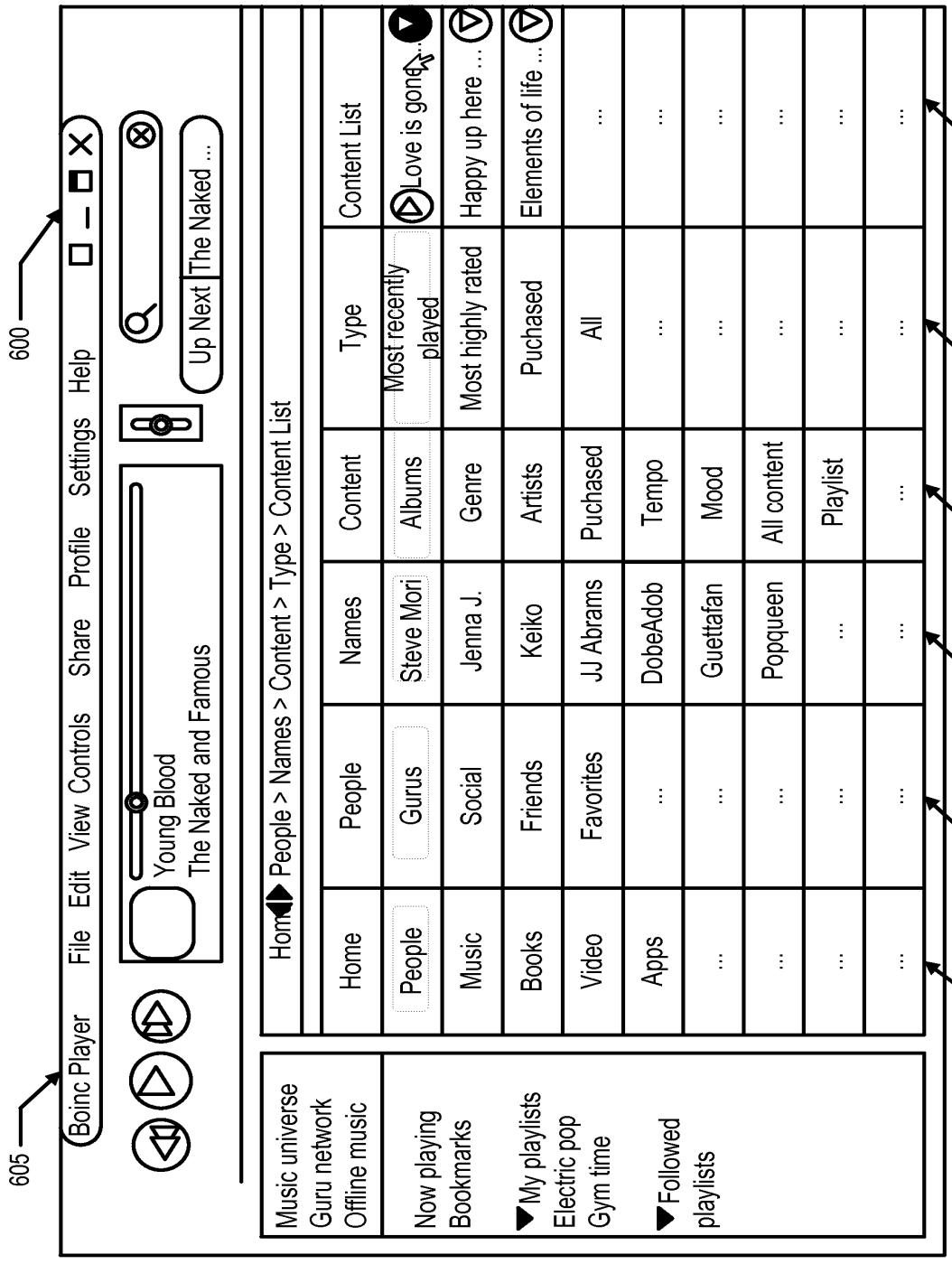

600
605
Boinc Player File Edit View Controls Share Profile Settings Help
Young Blood
The Naked and Famous
Up Next
The Naked ...
Music universe
Guru network
Offline music
Now playing
Bookmarks
My playlists
Electric pop
Gym time
Followed playlists
Hom
People > Names > Content > Type > Content List
Home
People
Names
Content
Type
Content List
People
Gurus
Steve Mori
Albums
Most recently played
Love is gone
Music
Social
Jenna J.
Genre
Most highly rated
Happy up here ...
Books
Friends
Keiko
Artists
Puchased
Elements of life ...
Video
Favorites
JJ Abrams
Puchased
All
Apps
DobeAdob
Tempo
Guettafan
Mood
Popqueen
All content
Playlist
610
612
614
616
618
620

FIGURE 6a

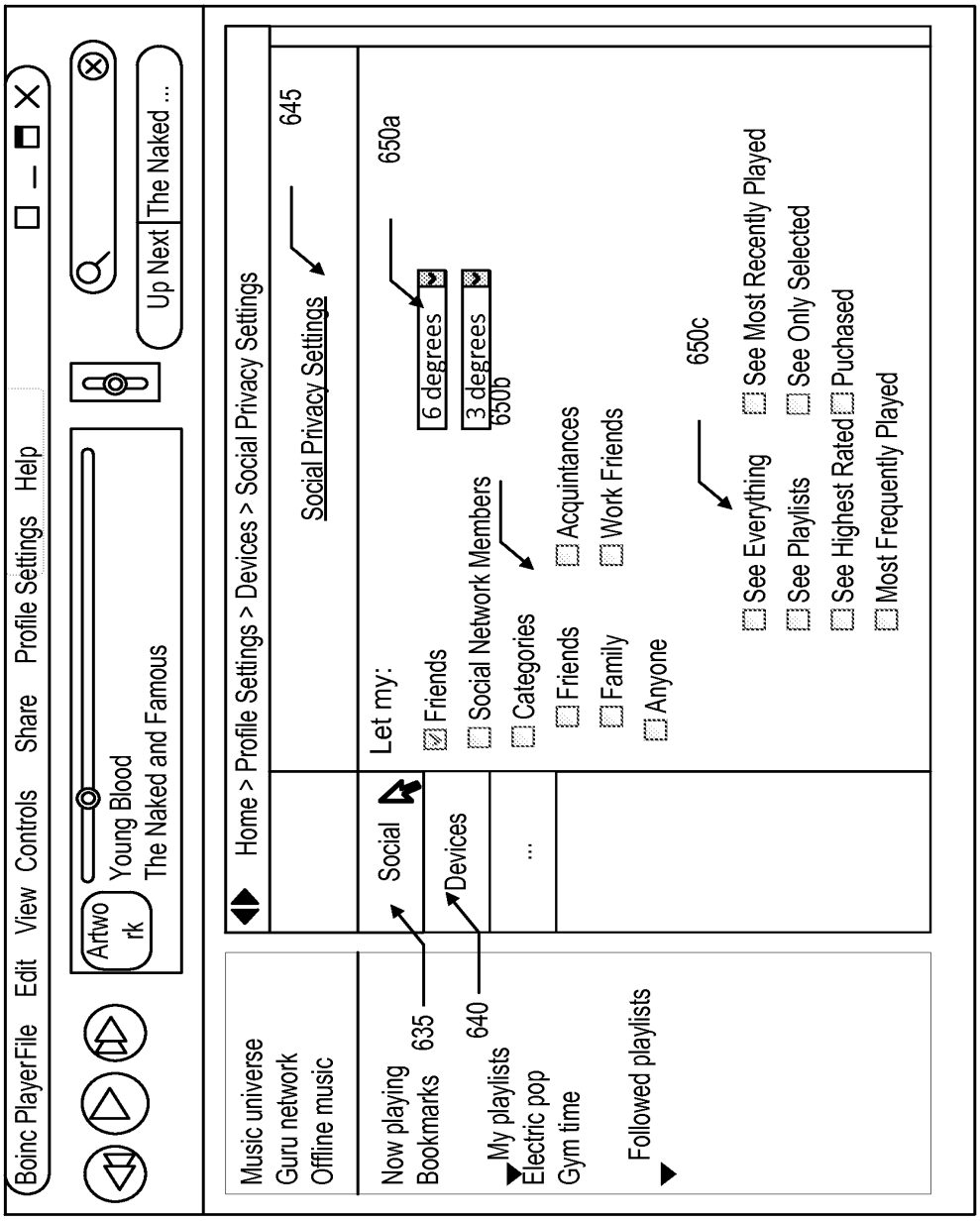

Boinc PlayerFile Edit View Controls Share Profile Settings Help
Artwo rk
Young Blood
The Naked and Famous
Up Next
The Naked ...
Music universe
Guru network
Offline music
Now playing
Bookmarks
My playlists
Electric pop
Gym time
Followed playlists
635
640
Home > Profile Settings > Devices > Social Privacy Settings
Social Privacy Settings
645
Social
Devices
...
Let my:
650a
Friends
6 degrees
Social Network Members
3 degrees
650b
Categories
Friends
Acquintances
Family
Work Friends
Anyone
650c
See Everything
See Most Recently Played
See Playlists
See Only Selected
See Highest Rated
Puchased
Most Frequently Played

FIGURE 6b

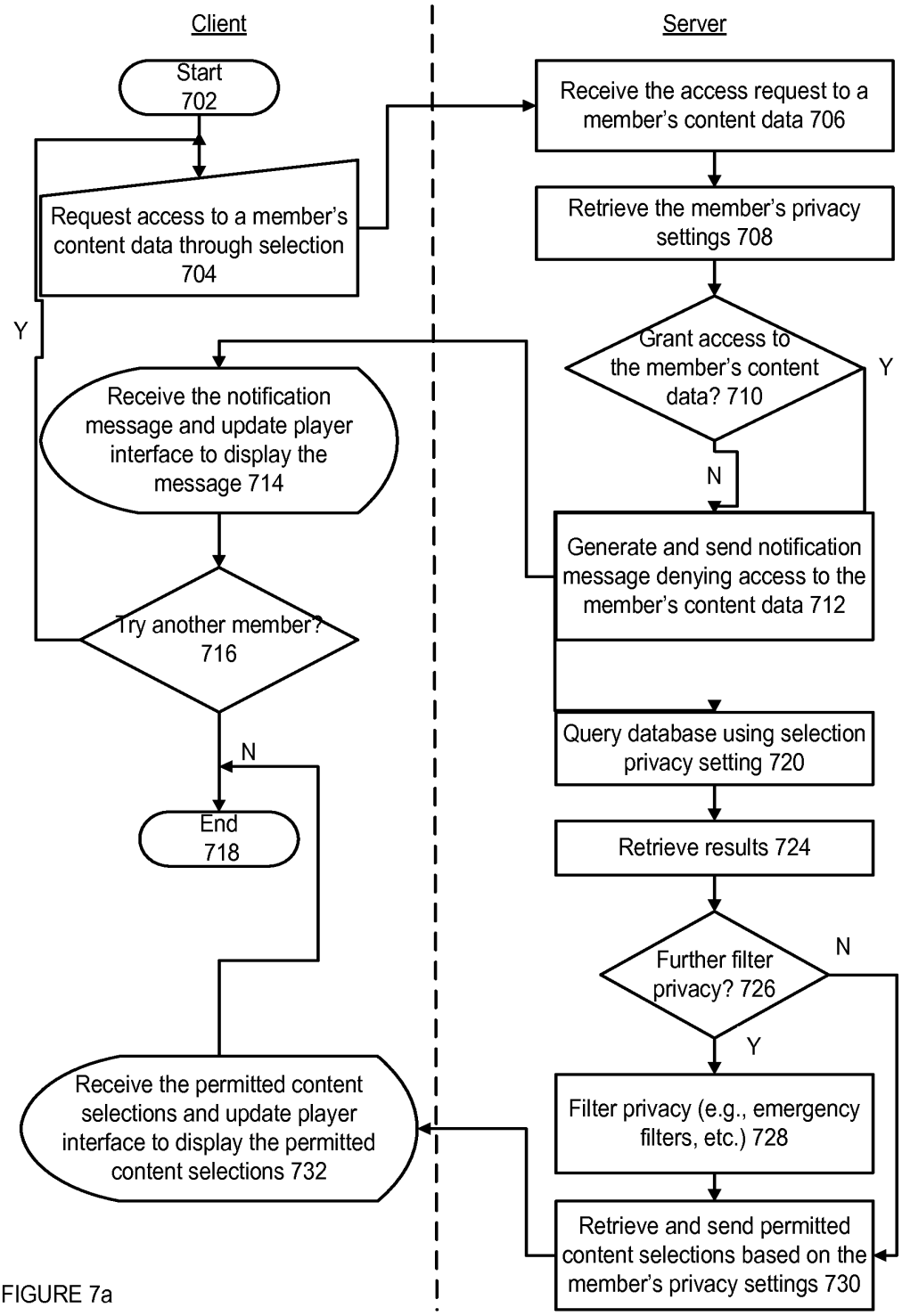

Client
Server
Start 702
Request access to a member's content data through selection 704
Receive the access request to a member's content data 706
Retrieve the member's privacy settings 708
Grant access to the member's content data? 710
Y
N
Receive the notification message and update player interface to display the message 714
Generate and send notification message denying access to the member's content data 712
Try another member? 716
Y
N
Query database using selection privacy setting 720
End 718
Retrieve results 724
Further filter privacy? 726
N
Y
Receive the permitted content selections and update player interface to display the permitted content selections 732
Filter privacy (e.g., emergency filters, etc.) 728
Retrieve and send permitted content selections based on the member's privacy settings 730

FIGURE 7a

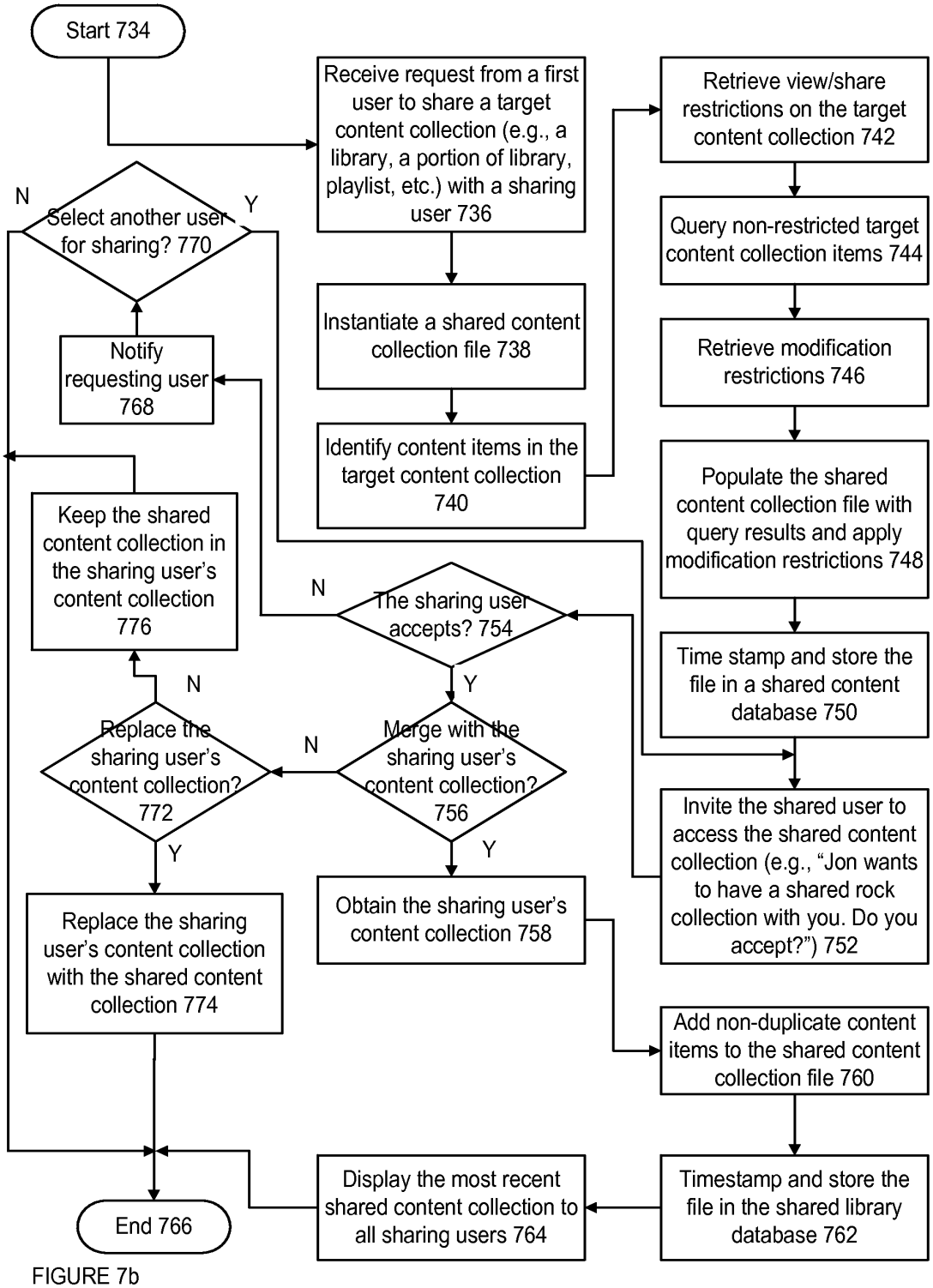

Start 734
Receive request from a first user to share a target content collection (e.g., a library, a portion of library, playlist, etc.) with a sharing user 736
Instantiate a shared content collection file 738
Identify content items in the target content collection 740
Retrieve view/share restrictions on the target content collection 742
Query non-restricted target content collection items 744
Retrieve modification restrictions 746
Populate the shared content collection file with query results and apply modification restrictions 748
Time stamp and store the file in a shared content database 750
Invite the shared user to access the shared content collection (e.g., "Jon wants to have a shared rock collection with you. Do you accept?") 752
The sharing user accepts? 754
N
Y
Merge with the sharing user's content collection? 756
N
Y
Obtain the sharing user's content collection 758
Add non-duplicate content items to the shared content collection file 760
Timestamp and store the file in the shared library database 762
Display the most recent shared content collection to all sharing users 764
End 766
Select another user for sharing? 770
N
Y
Notify requesting user 768
Keep the shared content collection in the sharing user's content collection 776
Replace the sharing user's content collection? 772
N
Y
Replace the sharing user's content collection with the shared content collection 774

FIGURE 7b

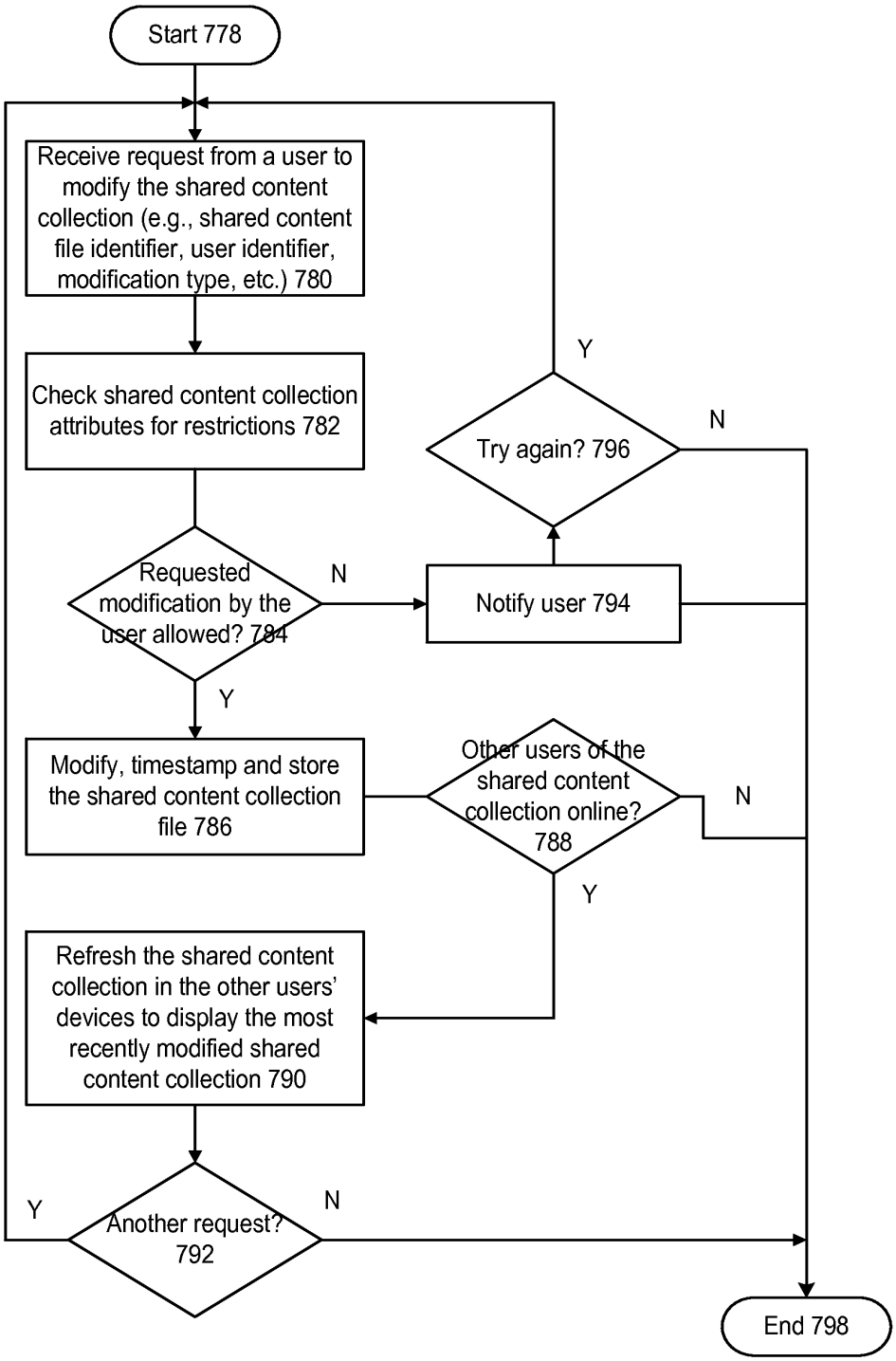

Start 778
Receive request from a user to modify the shared content collection (e.g., shared content file identifier, user identifier, modification type, etc.) 780
Check shared content collection attributes for restrictions 782
Requested modification by the user allowed? 784
N
Notify user 794
Try again? 796
Y
N
Y
Modify, timestamp and store the shared content collection file 786
Other users of the shared content collection online? 788
N
Y
Refresh the shared content collection in the other users' devices to display the most recently modified shared content collection 790
Another request? 792
Y
N
End 798

FIGURE 7c

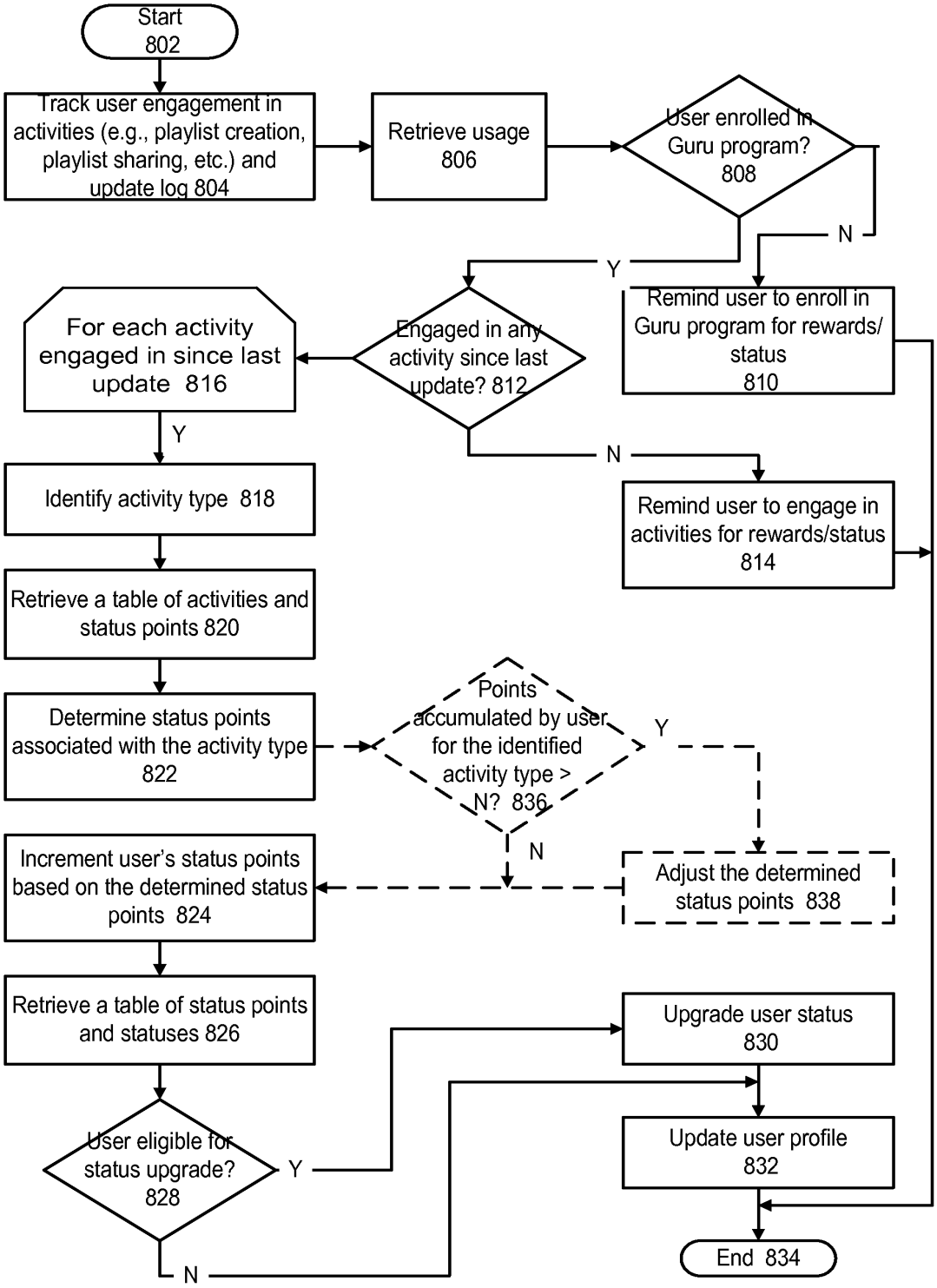

Start 802
Track user engagement in activities (e.g., playlist creation, playlist sharing, etc.) and update log 804
Retrieve usage 806
User enrolled in Guru program? 808
N
Y
Remind user to enroll in Guru program for rewards/ status 810
Engaged in any activity since last update? 812
For each activity engaged in since last update 816
Y
N
Identify activity type 818
Remind user to engage in activities for rewards/status 814
Retrieve a table of activities and status points 820
Determine status points associated with the activity type 822
Points accumulated by user for the identified activity type > N? 836
Y
N
Adjust the determined status points 838
Increment user's status points based on the determined status points 824
Retrieve a table of status points and statuses 826
Upgrade user status 830
User eligible for status upgrade? 828
Y
N
Update user profile 832
End 834

FIGURE 8a

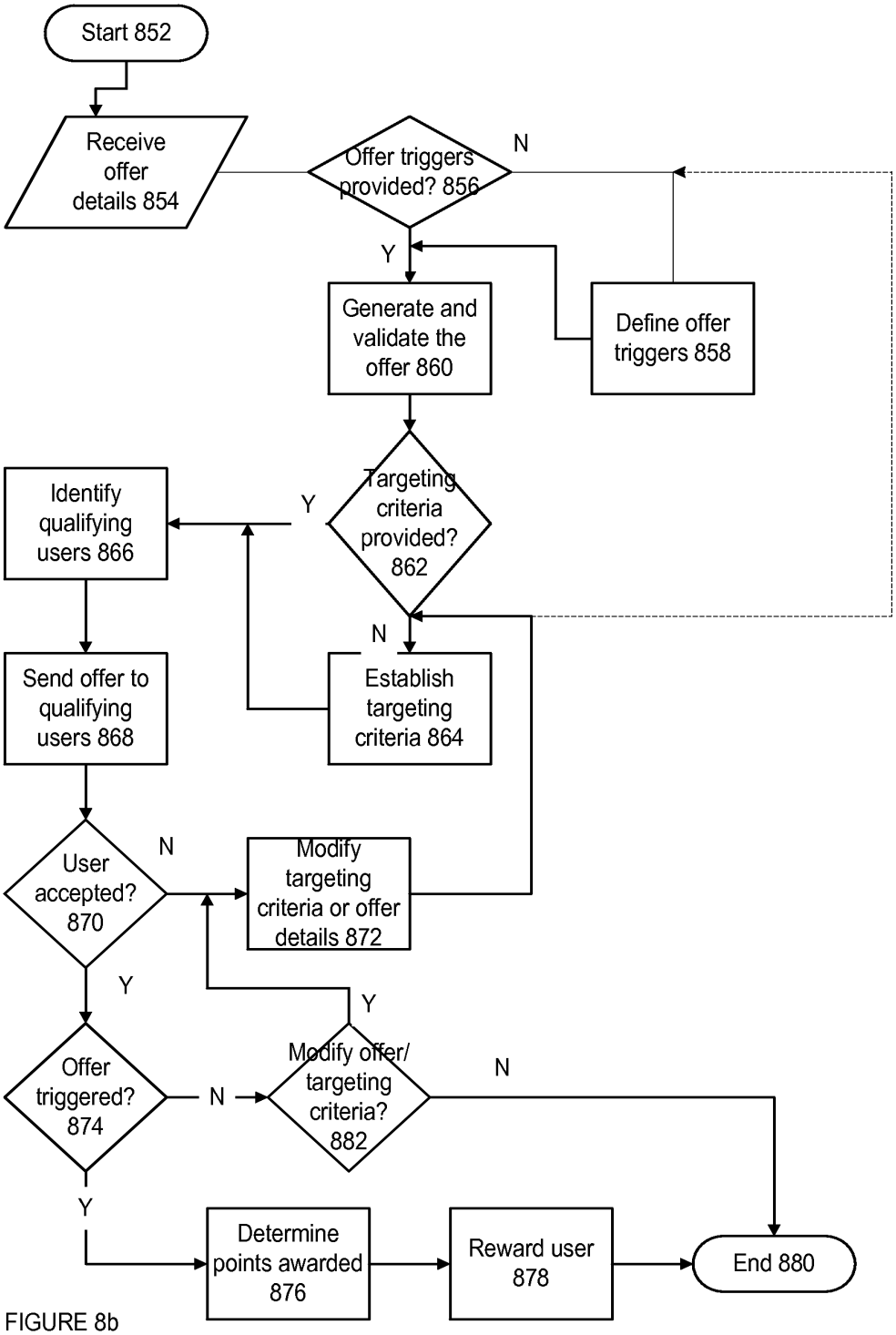

Start 852
Receive offer details 854
Offer triggers provided? 856
N
Y
Generate and validate the offer 860
Define offer triggers 858
Targeting criteria provided? 862
Y
Identify qualifying users 866
N
Establish targeting criteria 864
Send offer to qualifying users 868
User accepted? 870
N
Modify targeting criteria or offer details 872
Y
Y
Offer triggered? 874
N
Modify offer/ targeting criteria? 882
N
Y
Determine points awarded 876
Reward user 878
End 880

FIGURE 8b

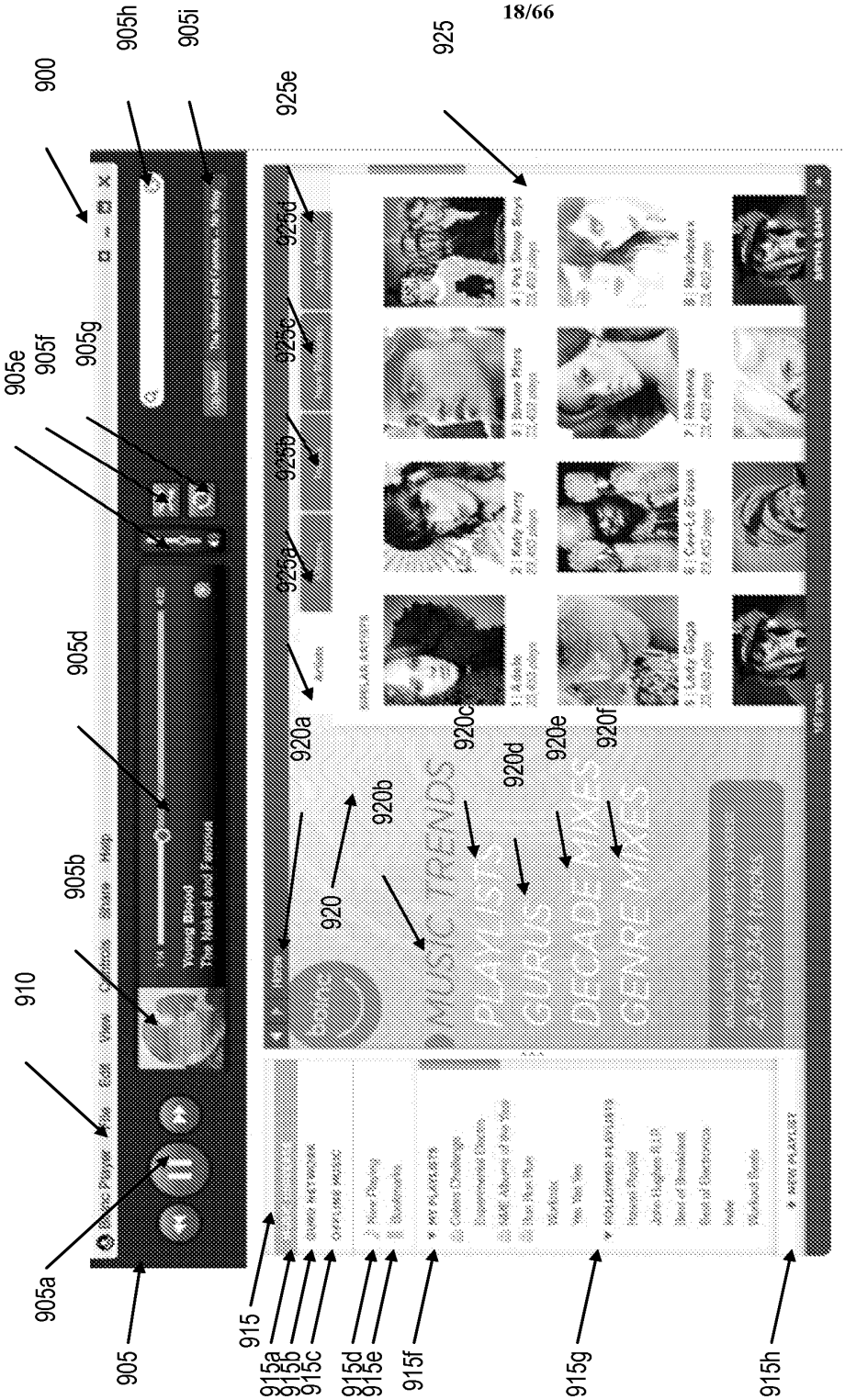

900
905h
905i
925
925e
905e
905f
905g
925d
925c
925b
925a
905d
920a
920c
920
920b
920d
920e
920f
905b
910
905a
905
915
915a
915b
915c
915d
915e
915f
915g
915h

FIGURE 9

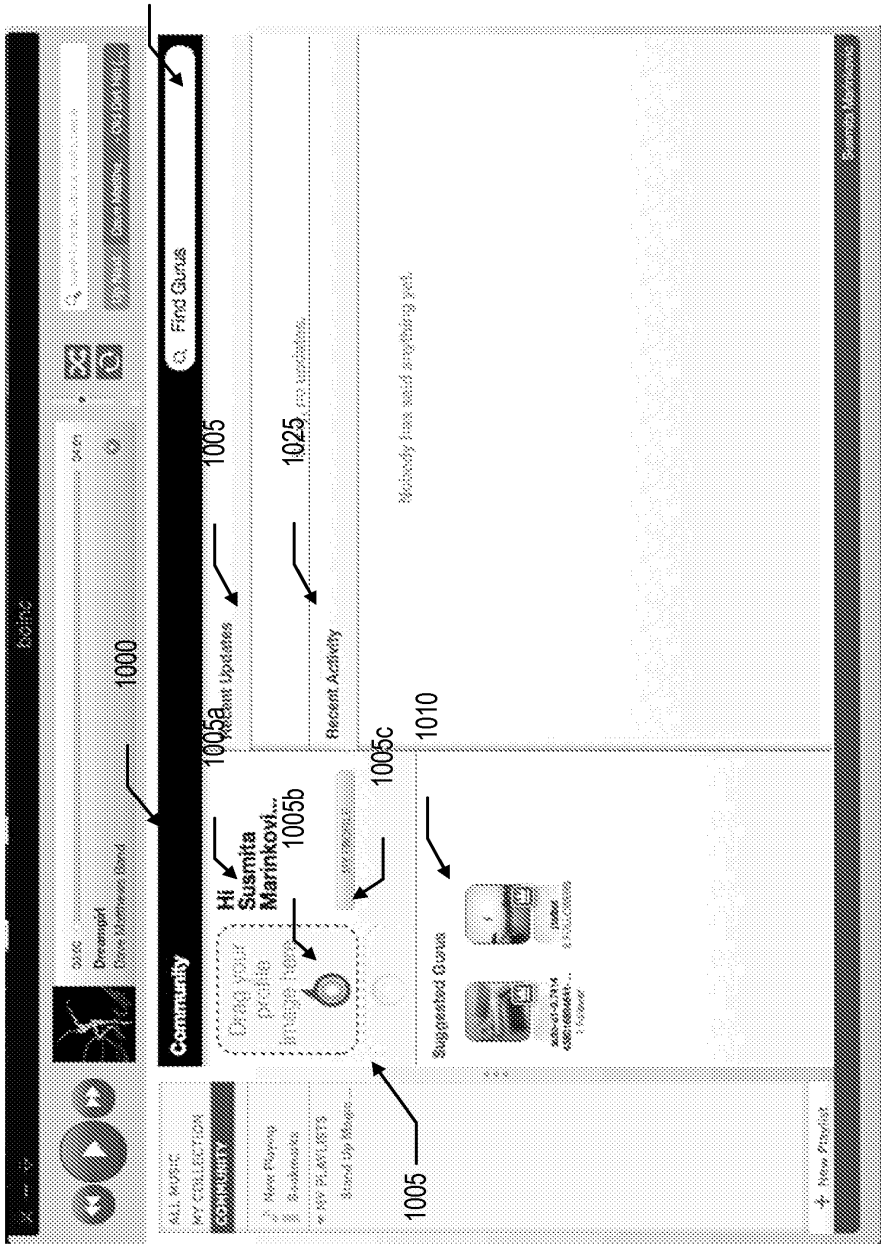

1020
1000
1005
1005a
1025
1005b
1005c
1010
1005
Find Gurus
Community
Hi Susmita Marinkovi...
Drag your profile image here
Suggested Gurus
Recent Activity
Recently from users and anything pub...
New Playlist

FIGURE 10

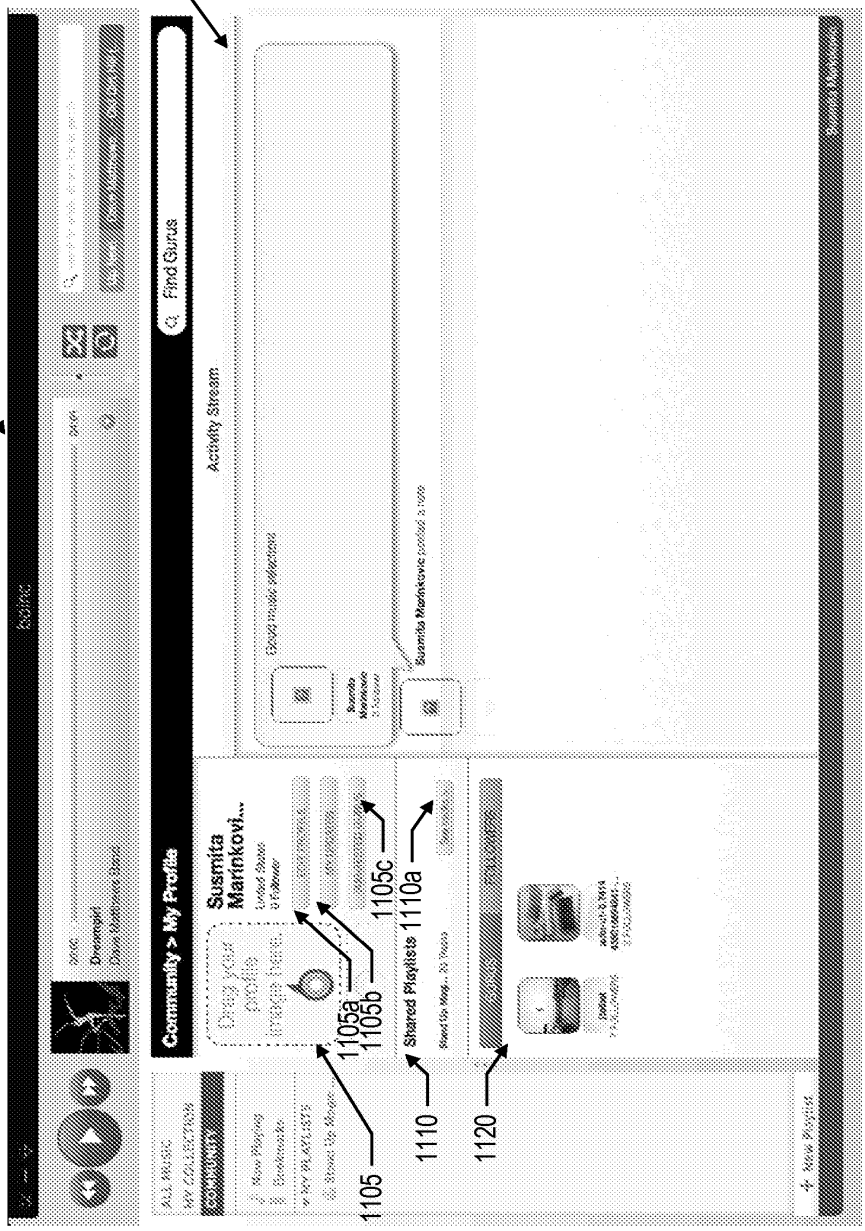

1100
1125
Community > My Profile
Find Gurus
Activity Stream
Susmita Marinkovi...
Drag your profile image here.
Shared Playlists
1105
1105a
1105b
1105c
1110
1110a
1120

FIGURE 11a

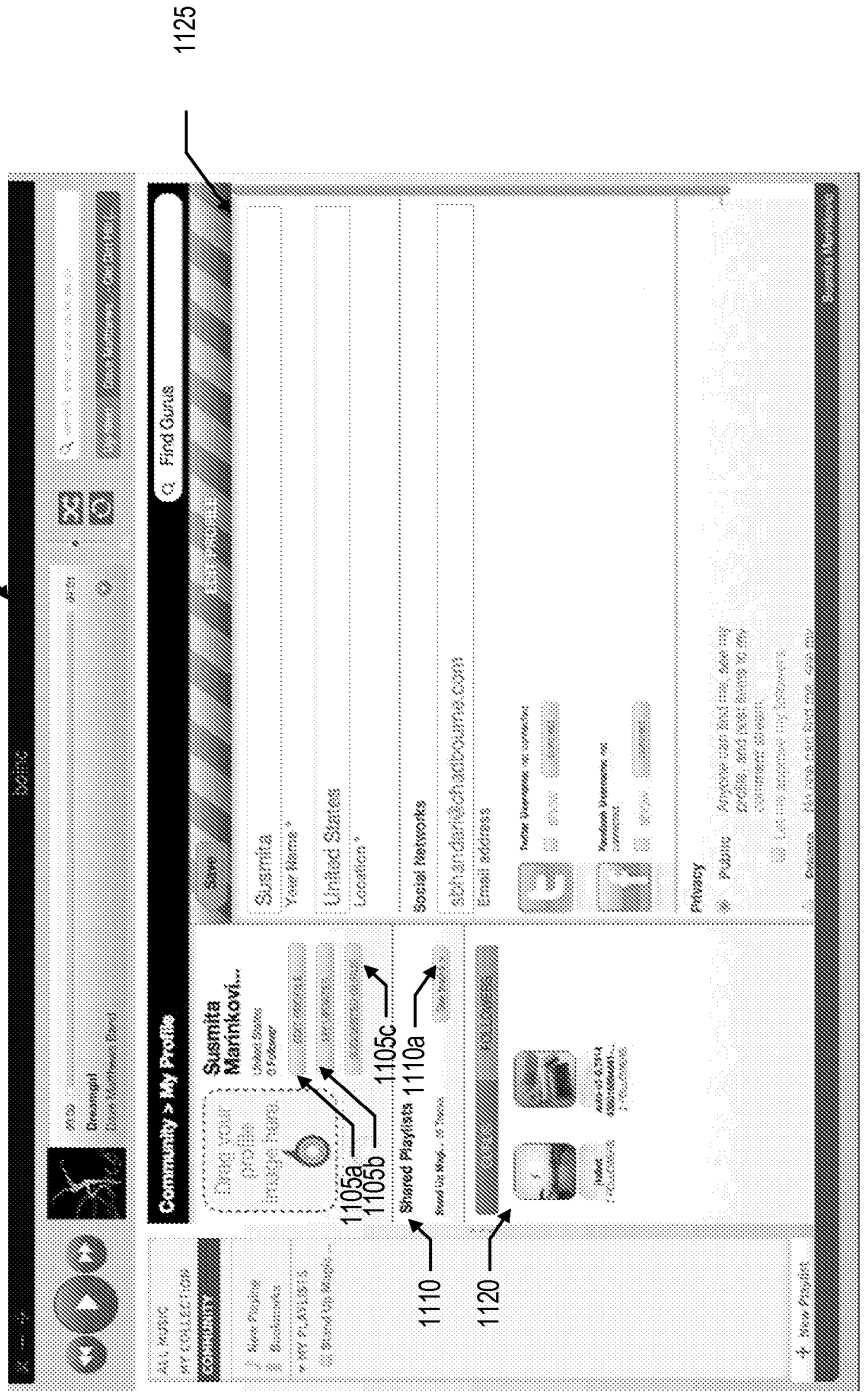

1100
1125
Community > My Profile
Find Gurus
Susmita Marinkovi...
Drag your profile image here
Susmita
Your Name *
United States
Location *
Social Networks
Email Address
Privacy
Shared Playlists
1105a
1105b
1105c
1110a
1110
1120

FIGURE 11b

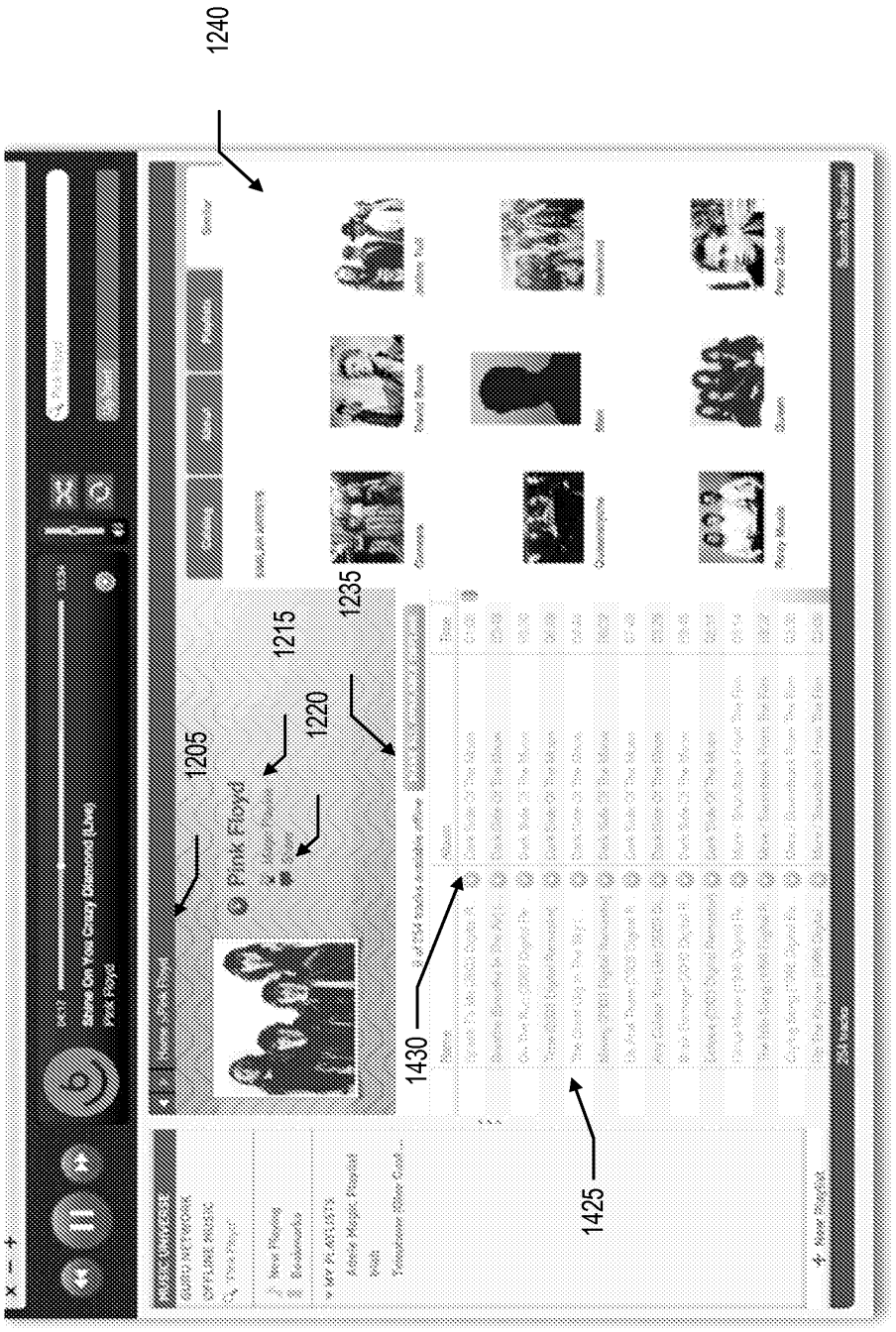


FIGURE 12a

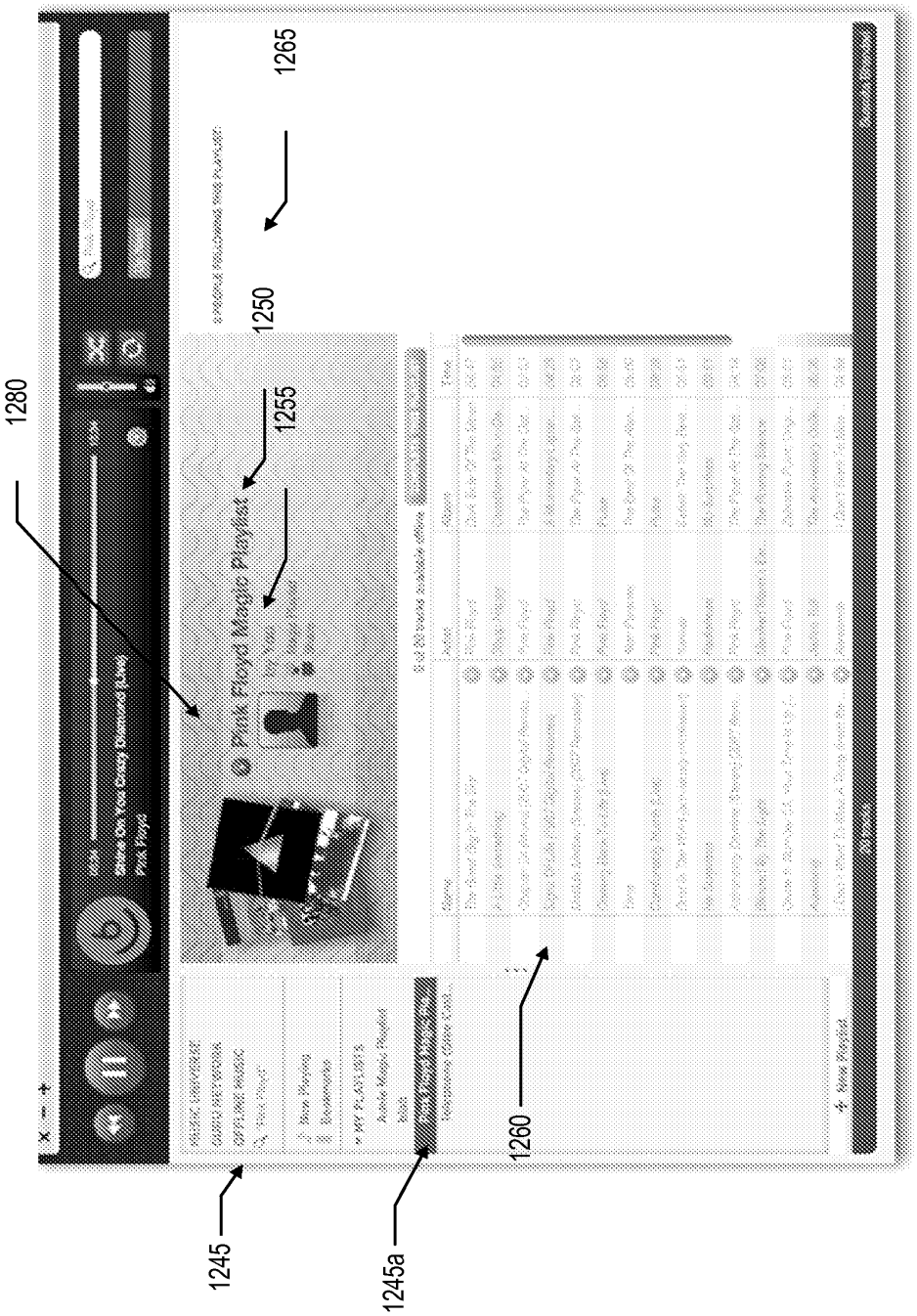

1280
1255
1250
1265
1245
1245a
1260
Pink Floyd Magic Playlist

FIGURE 12b

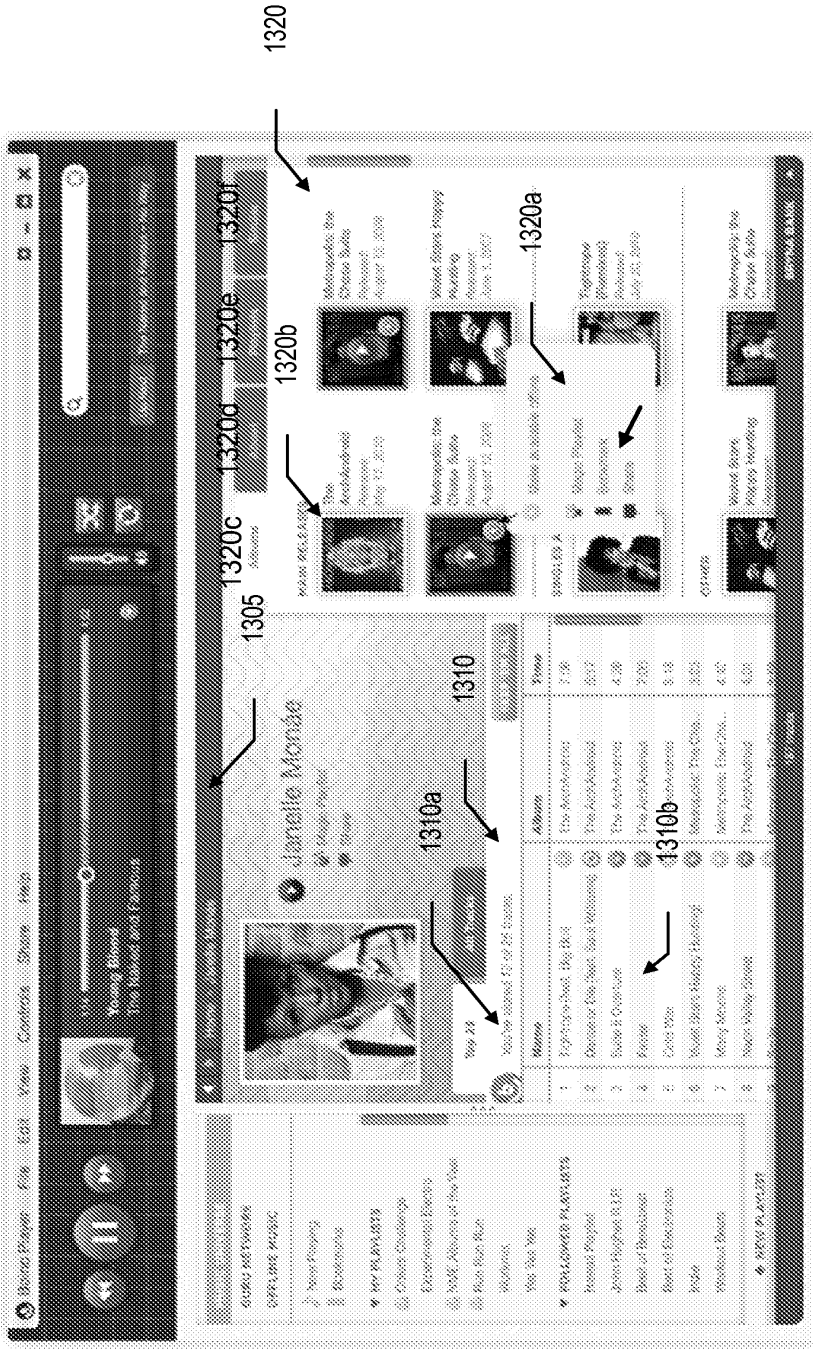

1320
1320c
1320d
1320e
1320f
1320b
1320a
1305
1310
1310a
1310b

FIGURE 13a



FIGURE 13b

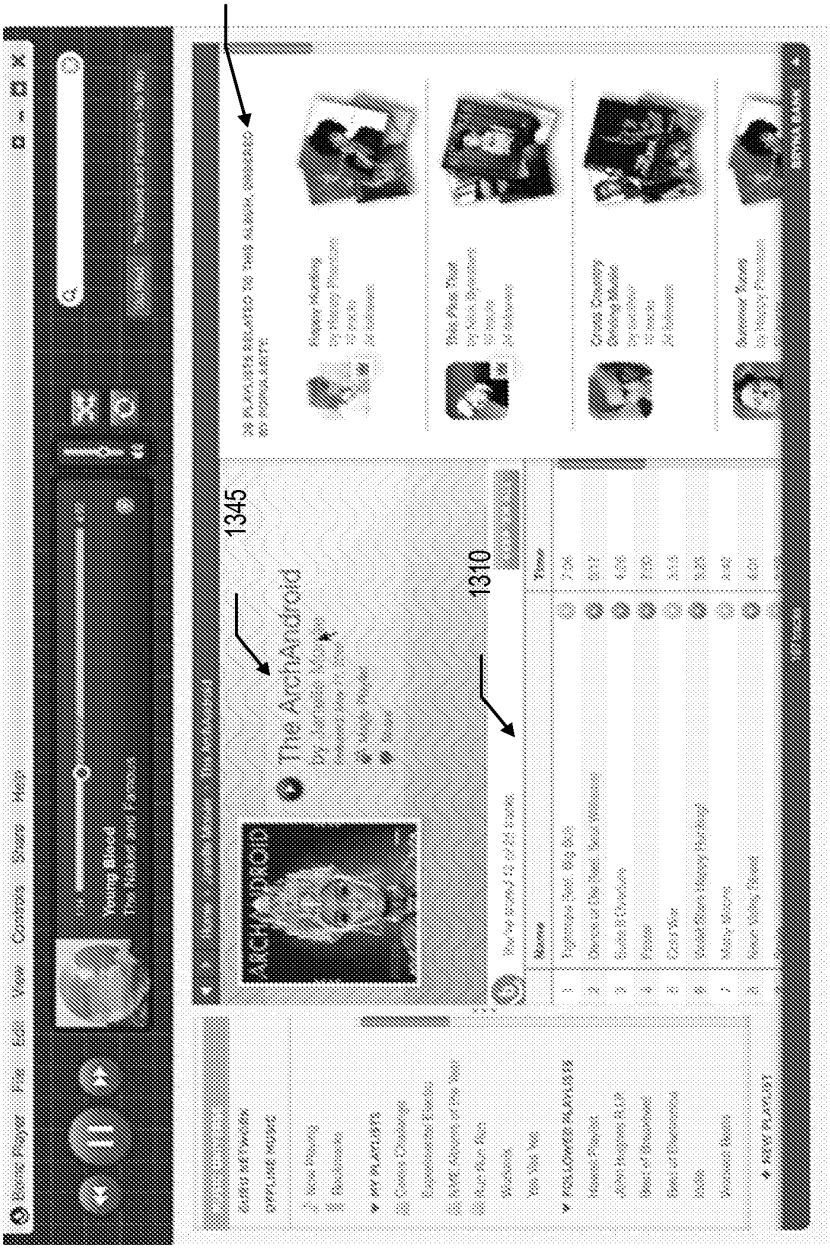


FIGURE 13c

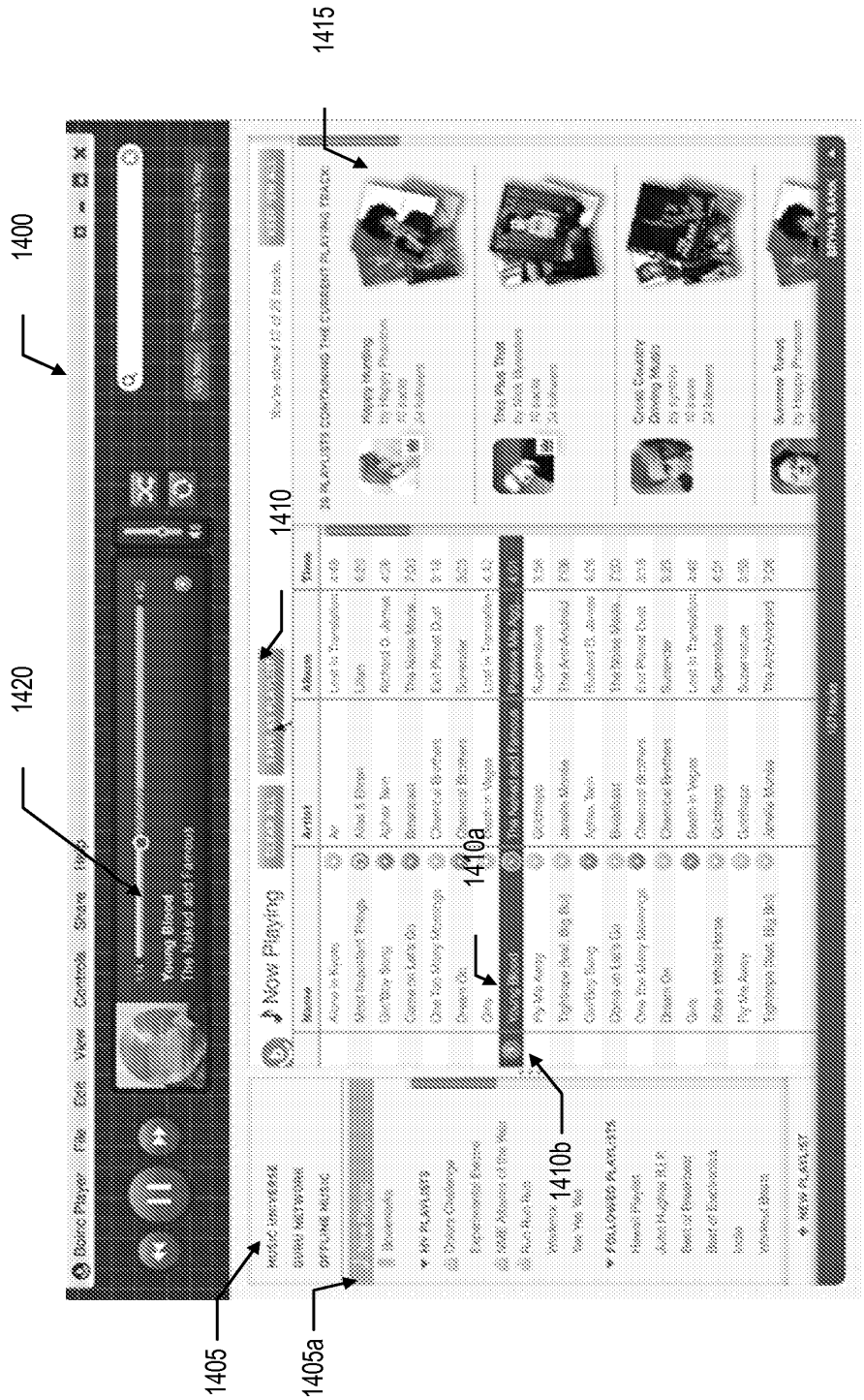


FIGURE 14

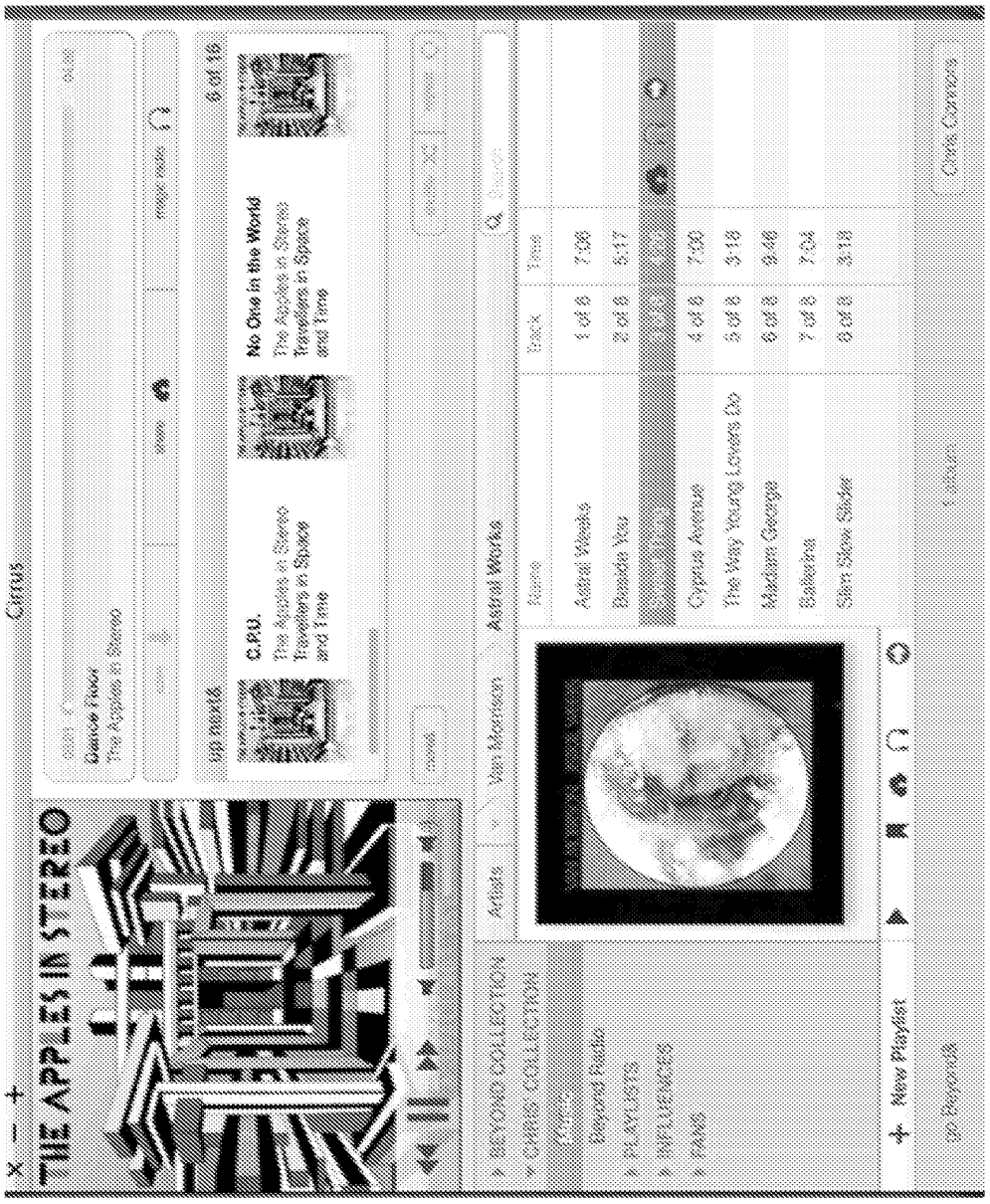

THE APPLES IN STEREO
Cirrus
Dance Floor
The Apples in Stereo
C.P.U.
The Apples in Stereo
Travelers in Space and Time
No One in the World
The Apples in Stereo
Travelers in Space and Time
6 of 16
Astral Works
Name
Time
Astral Works
1 of 8
7:06
Beside You
2 of 8
5:17
Cypress Avenue
4 of 8
7:50
The Way Young Lovers Do
5 of 8
3:18
Martian George
6 of 8
9:46
Ballerina
7 of 8
7:04
Skin Slow Slider
8 of 8
3:18
New Playlist
Open
Clear Content

FIGURE 15a

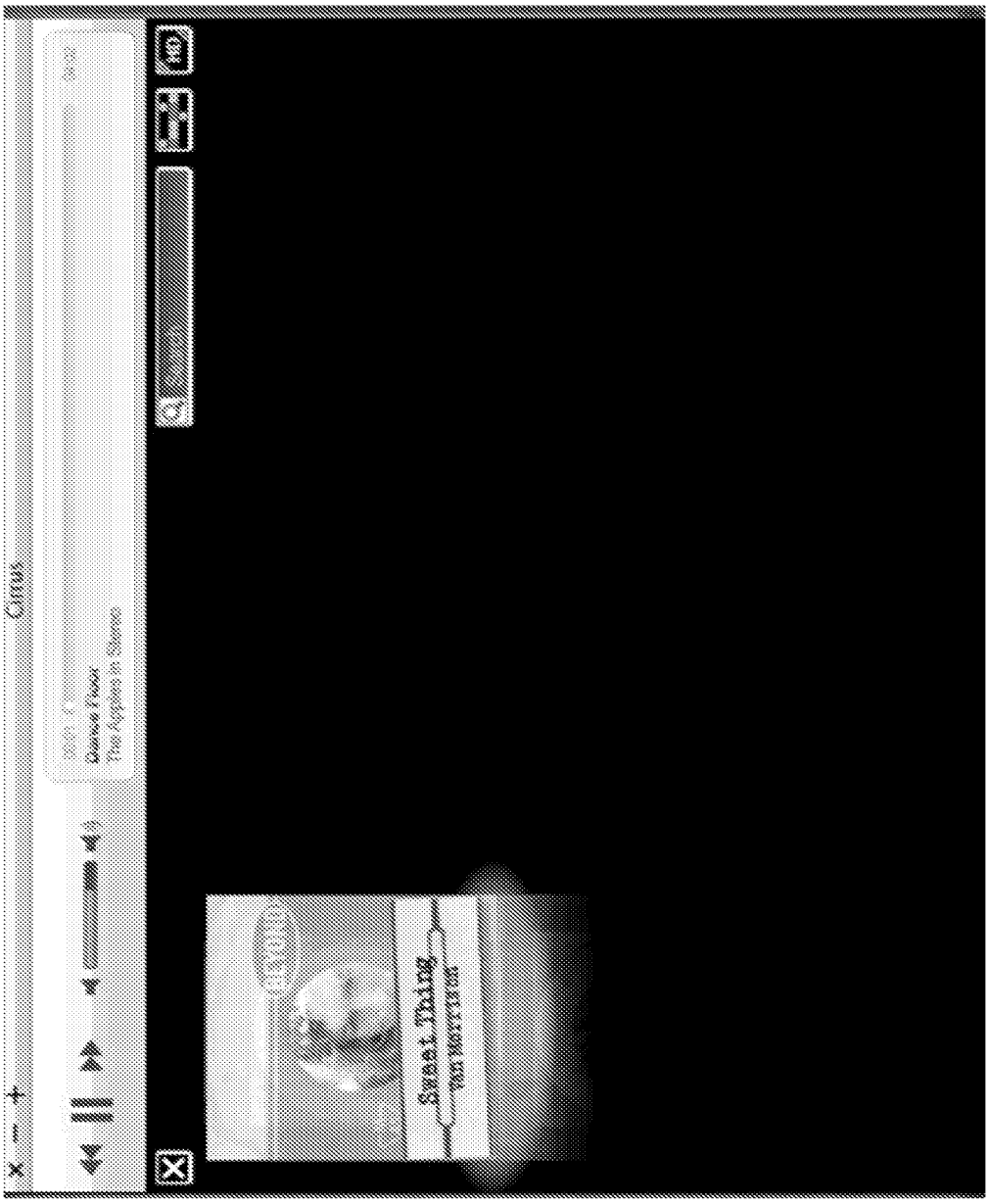


FIGURE 15b

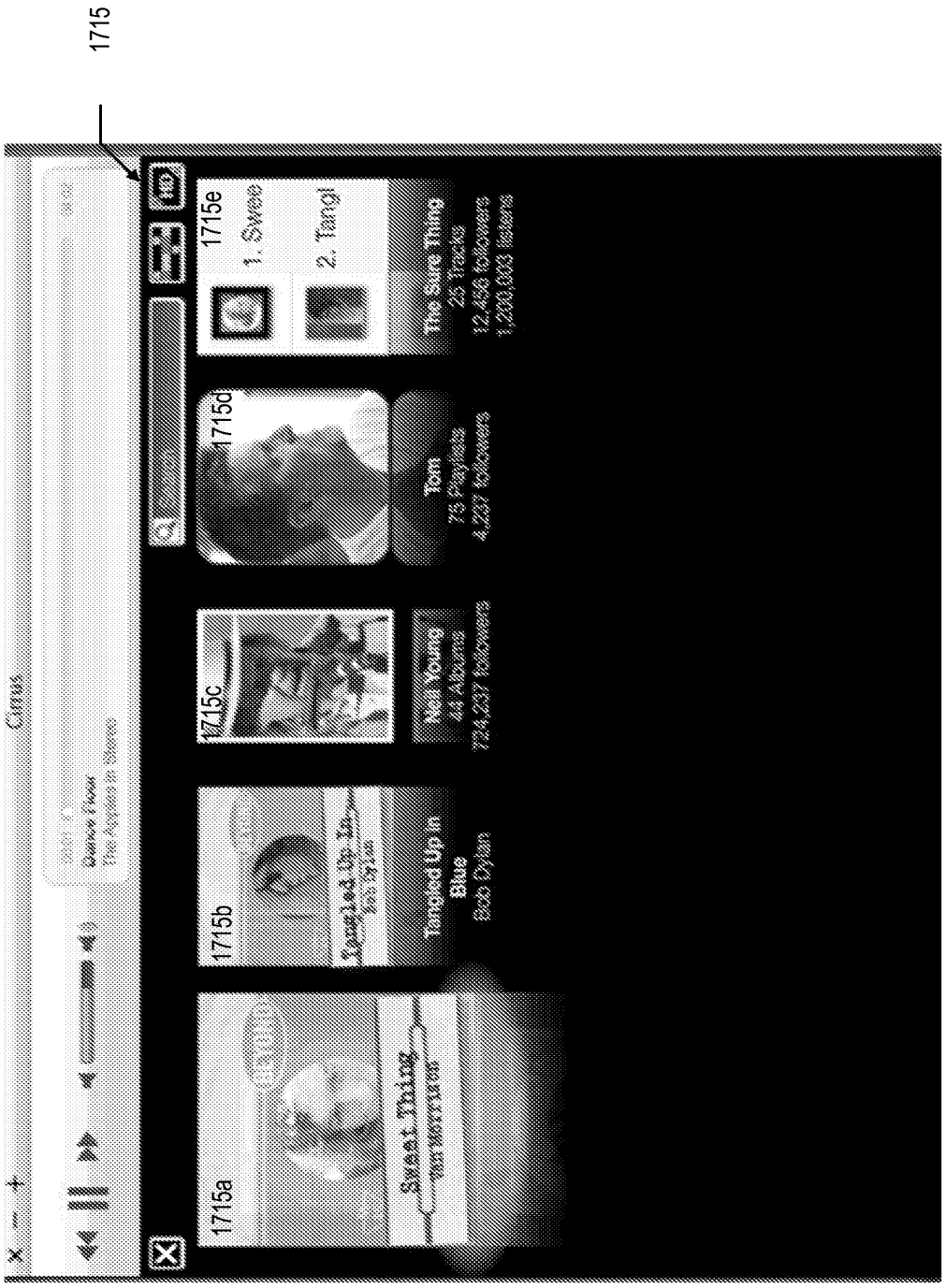

1715
Cities
1715a
Sweet Thing
1715b
Tangled Up In Blue
Bob Dylan
1715c
Nick Young
44 Albums
724,237 followers
1715d
Tom
78 Playlists
4,237 followers
1715e
1. Swee
2. Tangl
The Sure Thing
25 Tracks
12,456 followers
1,200,003 listens

FIGURE 15c

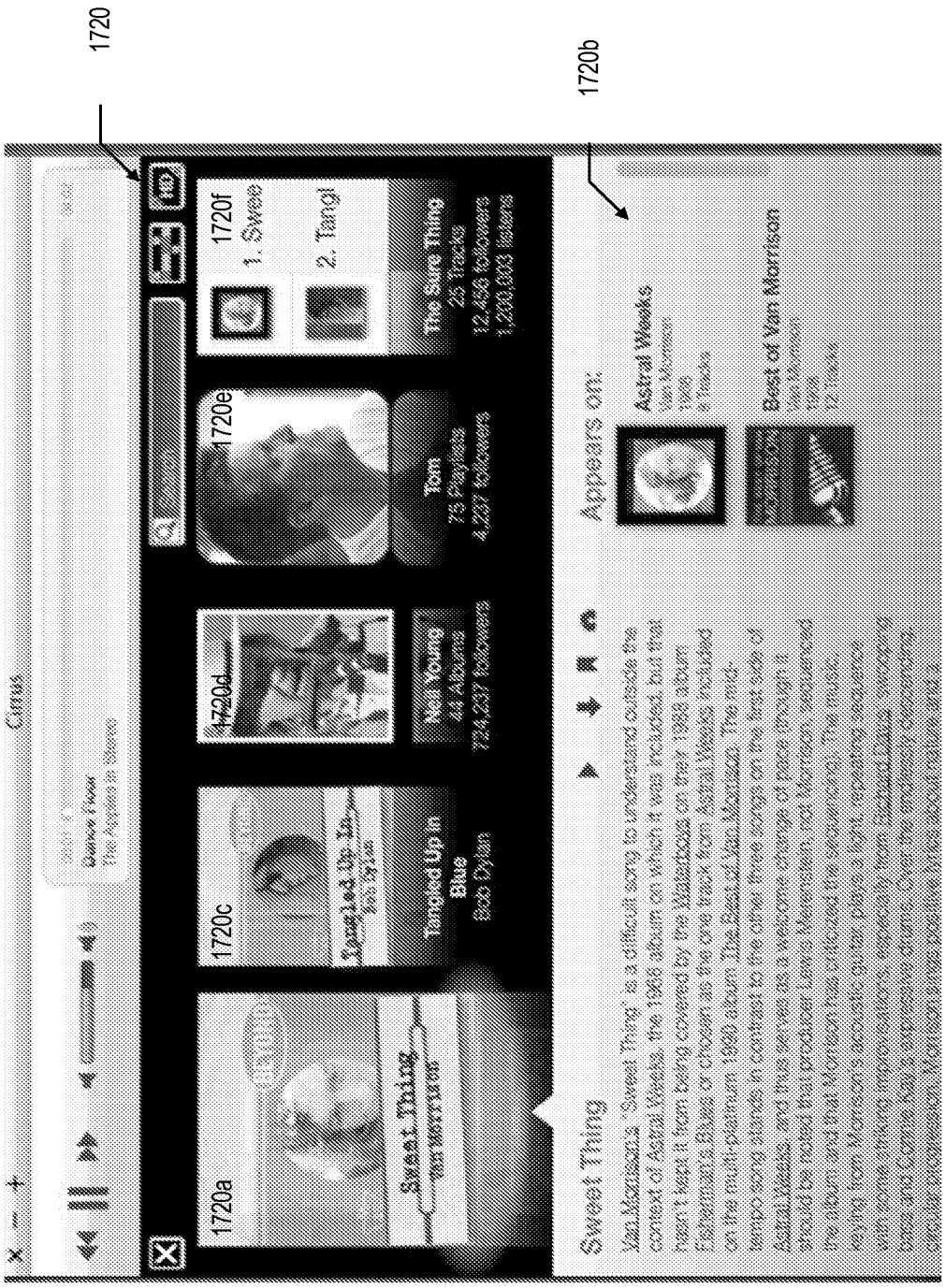

1720
1720b
1720a
1720c
1720d
1720e
1720f
Sweet Thing
Tangled Up In Blue
Bob Dylan
Nils Young
44 Albums
724,237 followers
Tom
73 Playlists
4,237 followers
The Sure Thing
25 Tracks
12,456 followers
1,200,003 listens
1. Swee
2. Tangl
Appears on:
Astral Weeks
Best of Van Morrison

FIGURE 15d

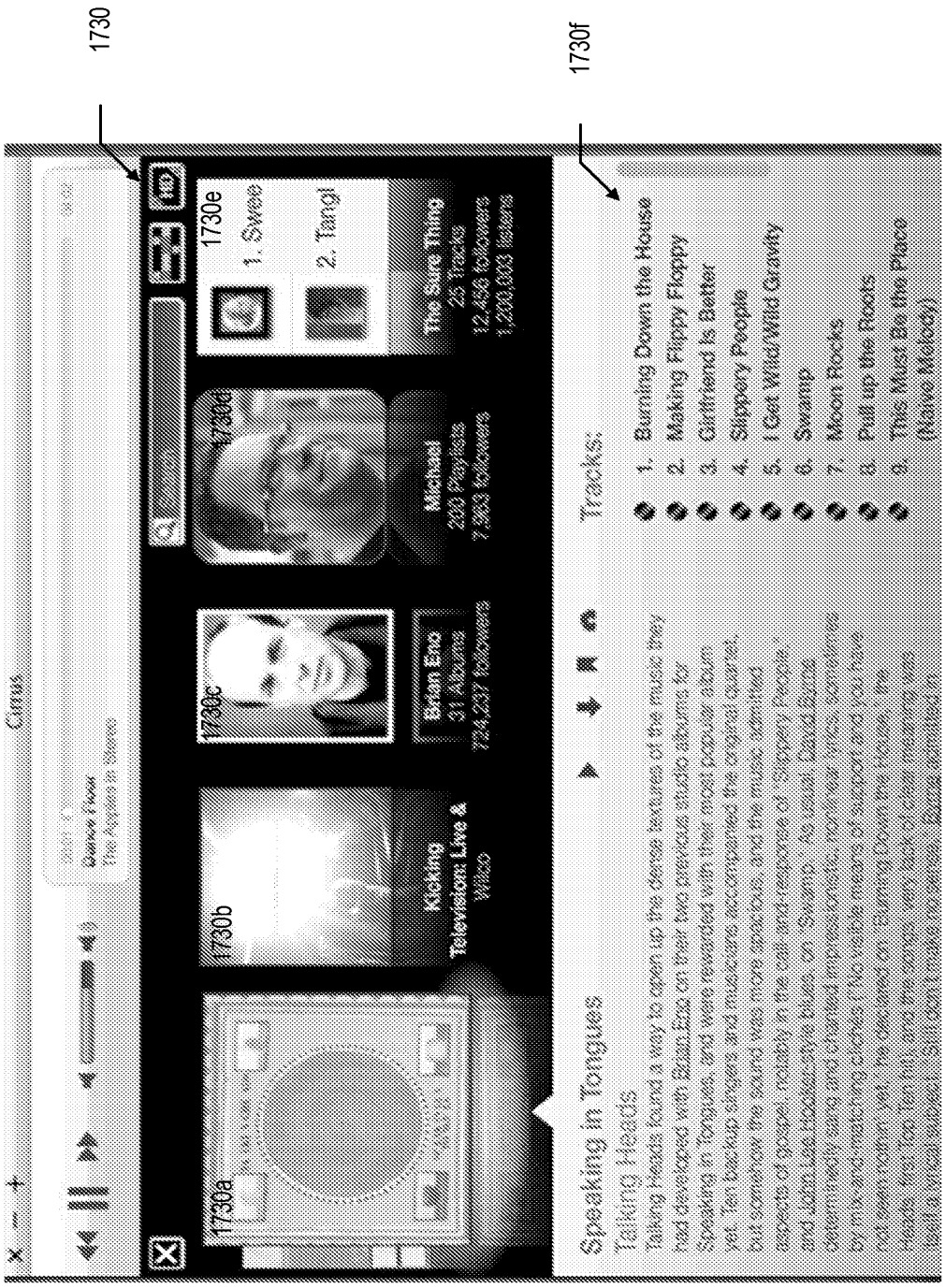

1730
1730f
1730a
1730b
1730c
1730d
1730e
Speaking in Tongues
Talking Heads
Tracks:
1. Burning Down the House
2. Making Flippy Floppy
3. Girlfriend Is Better
4. Slippery People
5. I Get Wild/Wild Gravity
6. Swamp
7. Moon Rocks
8. Pull Up the Roots
9. The Must Be the Place (Naive Melody)
Brian Eno
31 Albums
724,237 followers
Michael
200 Playlists
1,933 followers
The Sure Thing
25 Tracks
12,453 followers
1,200,003 listens
1. Swee
2. Tangl

FIGURE 15e

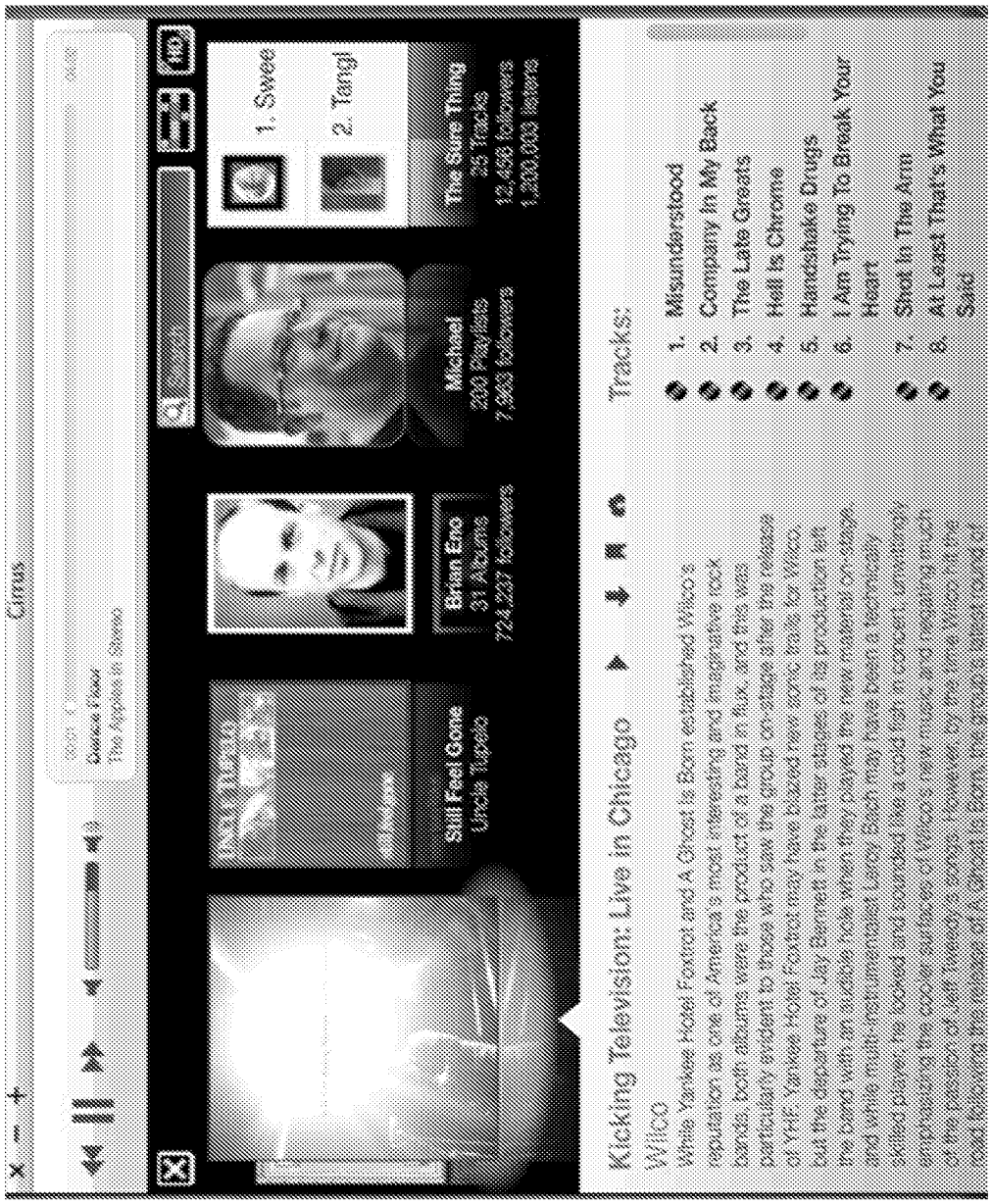

Circus
Still Feel Gone
UNKLE Tokyo
Brian Eno
31 Albums
724,237 followers
Michael
200 Playlists
7,003 followers
The Cure Thing
35 Tracks
12,450 followers
1,200,003 likes
1. Swee
2. Tangl
Kicking Television: Live in Chicago
Wilco
Tracks:
1. Misunderstood
2. Company In My Back
3. The Late Greats
4. Hell Is Chrome
5. Handshake Drugs
6. I Am Trying To Break Your Heart
7. Shot In The Arm
8. At Least That's What You Said

FIGURE 15f

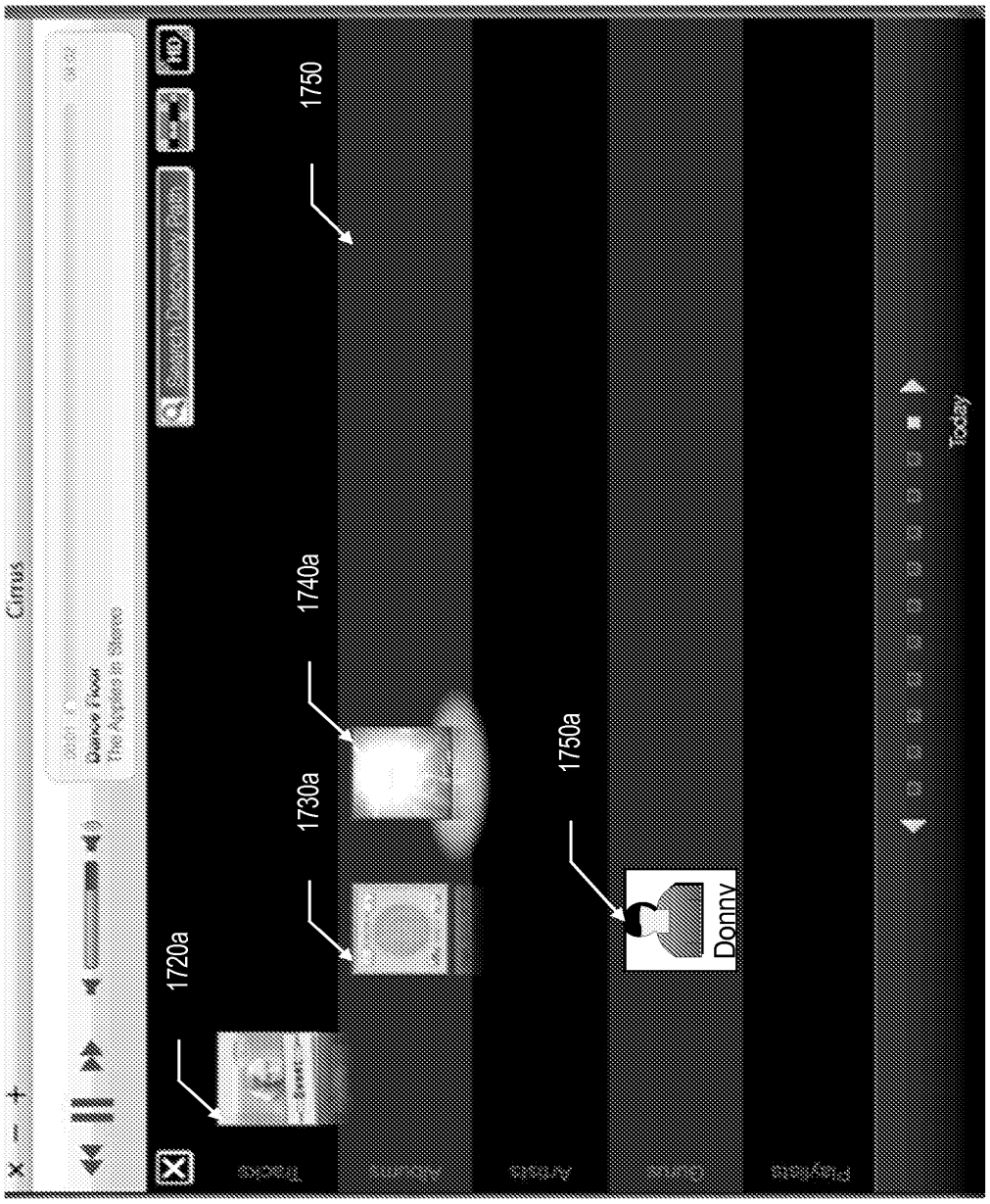


FIGURE 15g

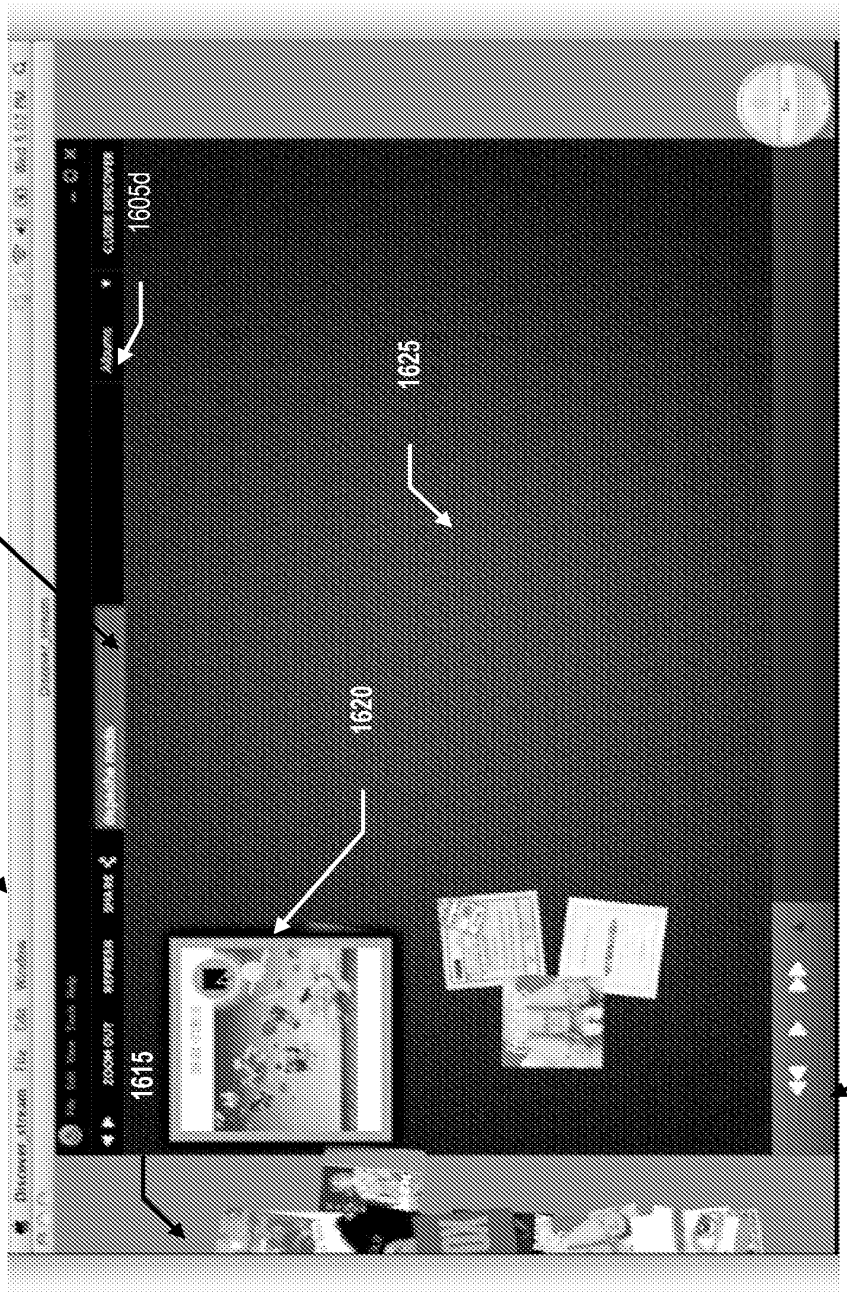


FIGURE 16a

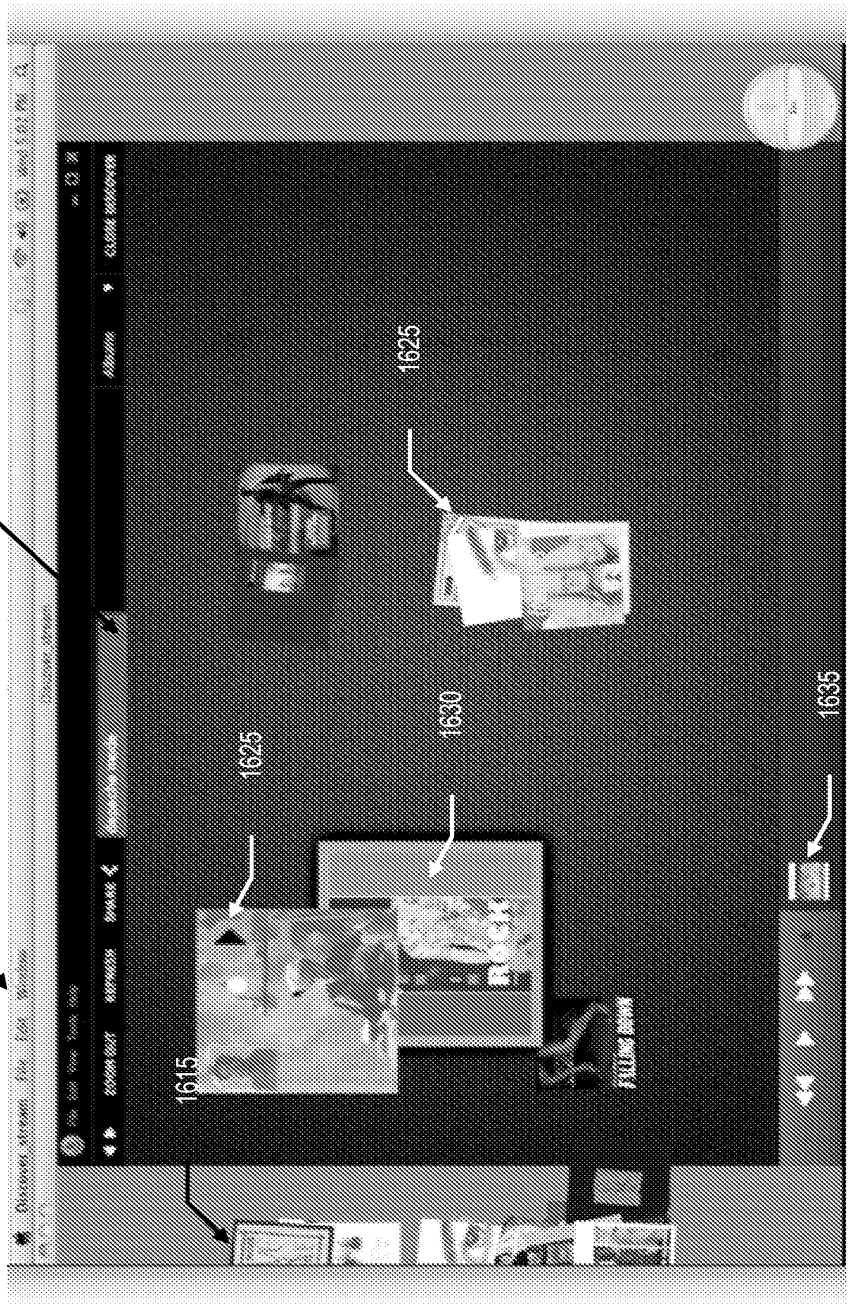


FIGURE 16b

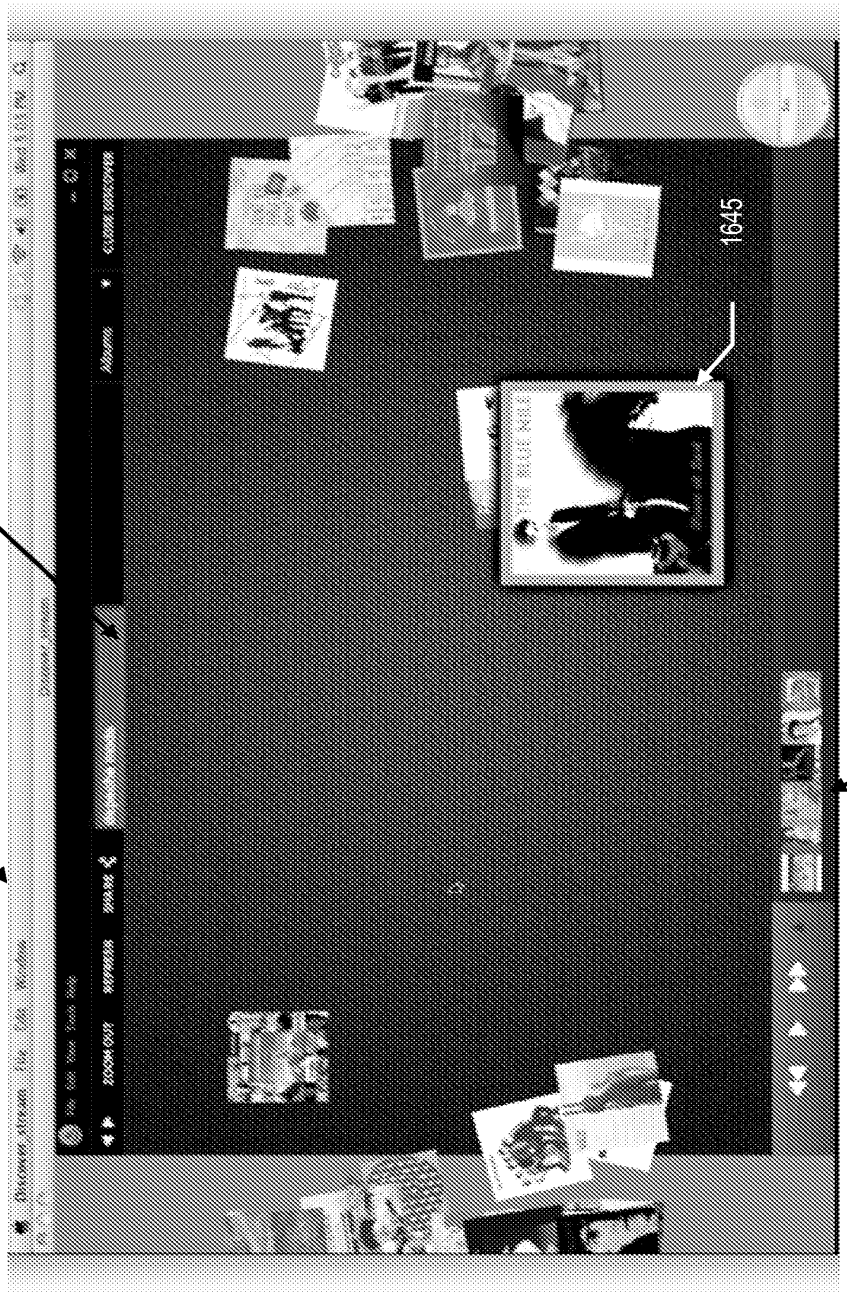


FIGURE 16c

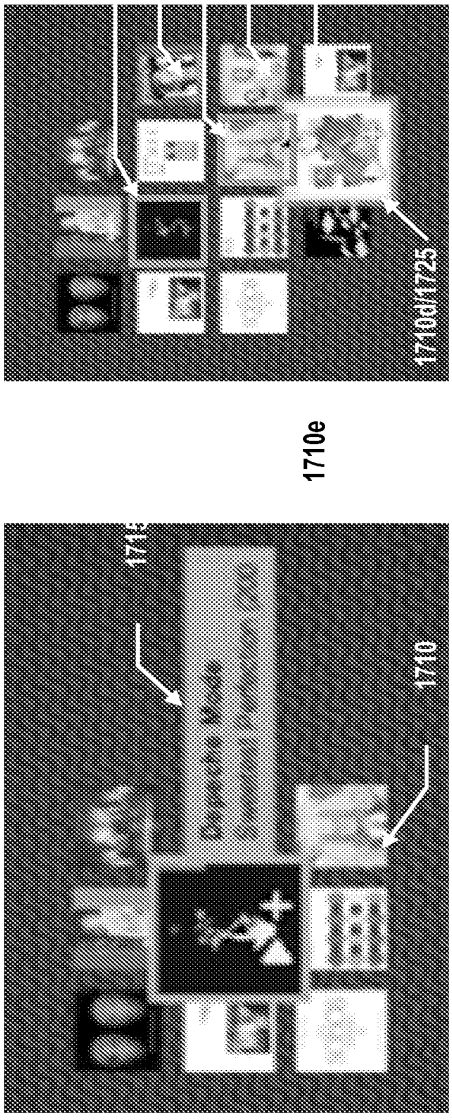


FIGURE 17a

FIGURE 17b

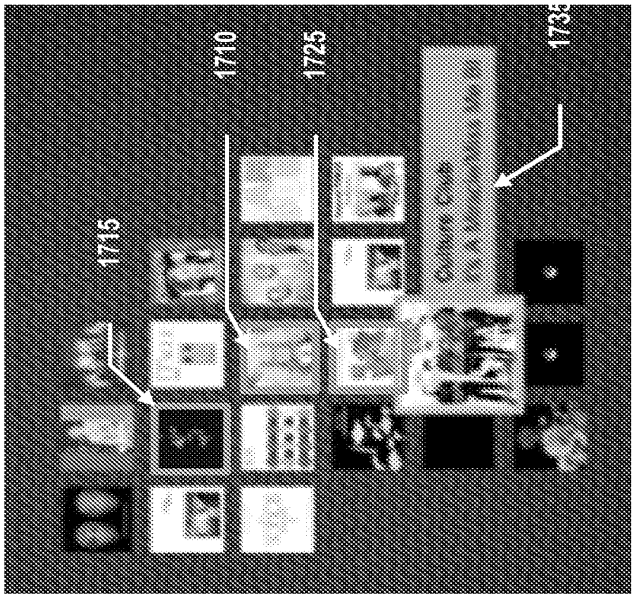


FIGURE 17c

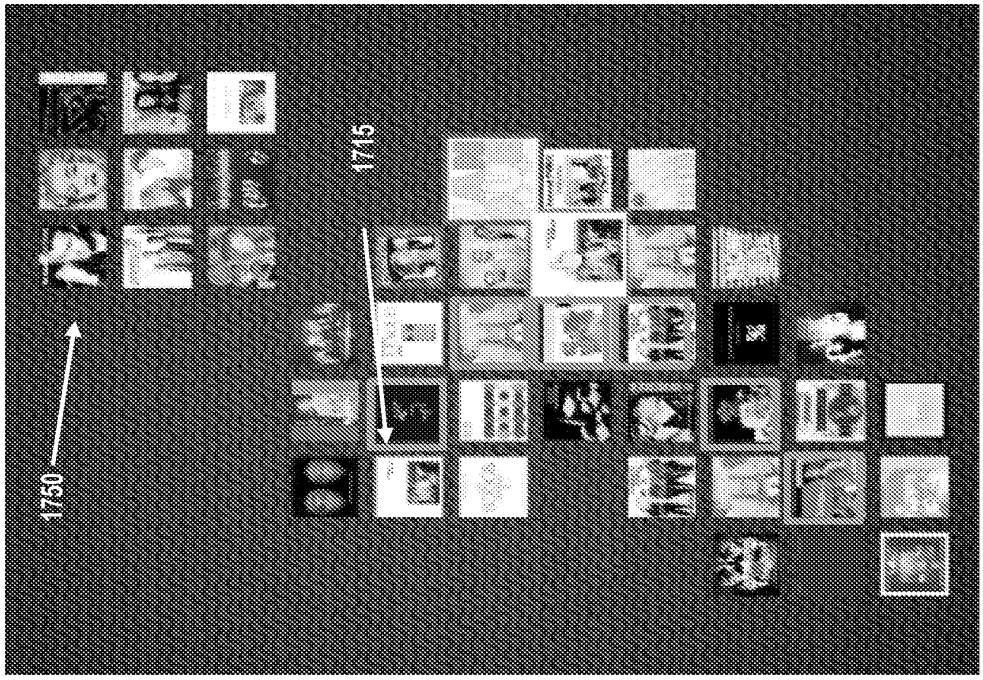


FIGURE 17e

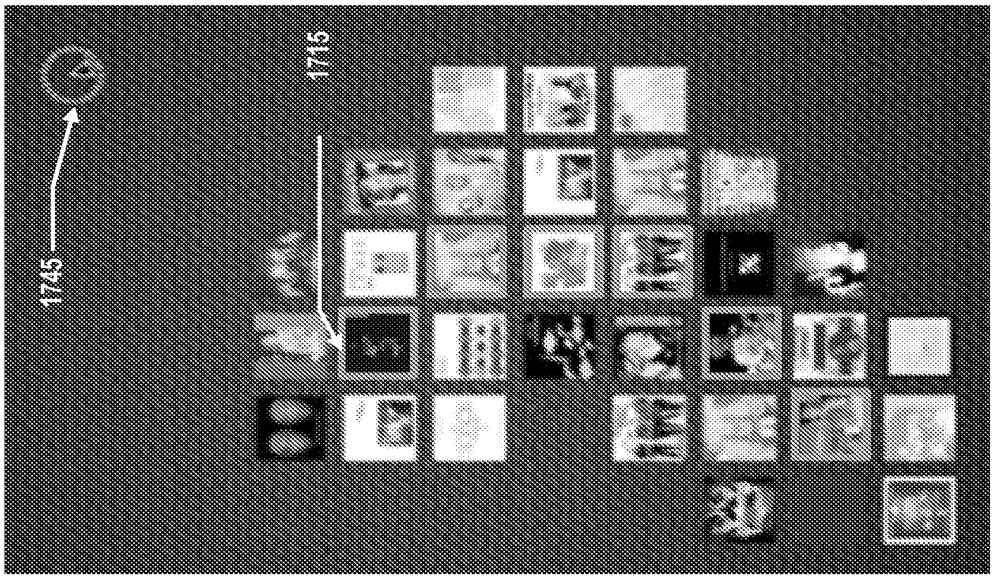


FIGURE 17d

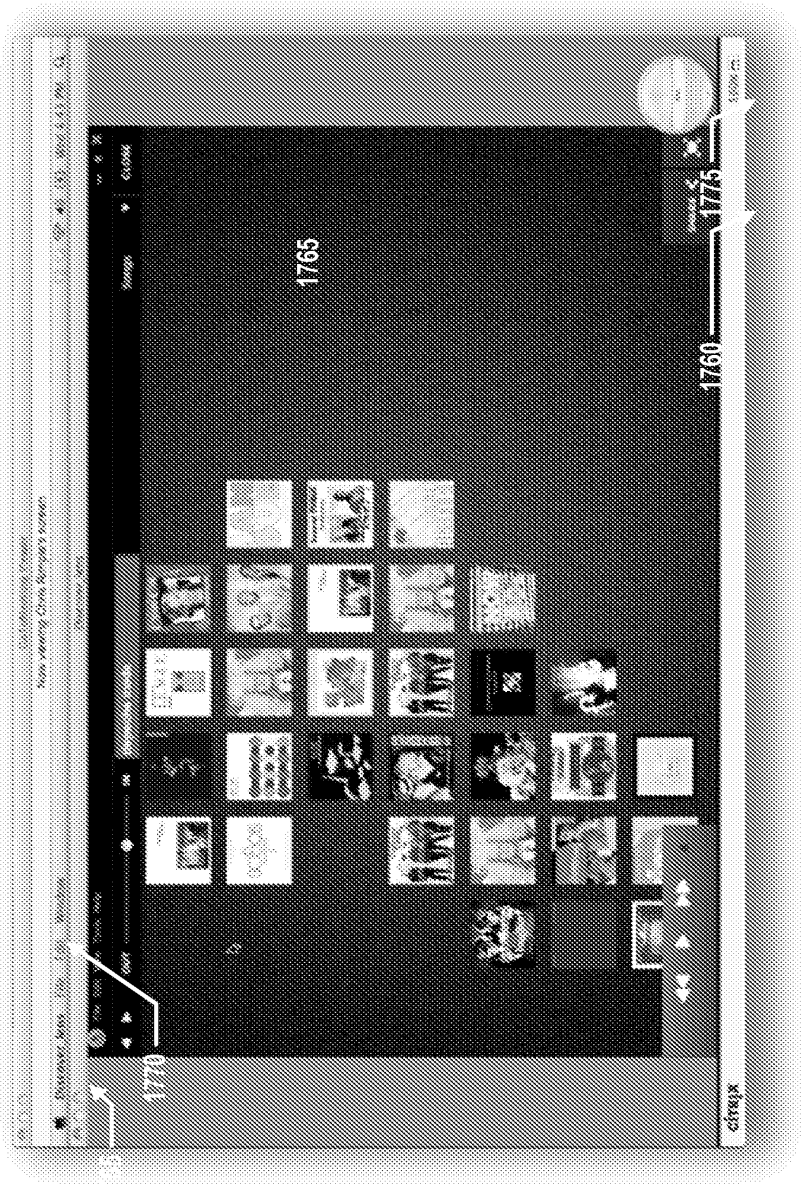


FIGURE 17f

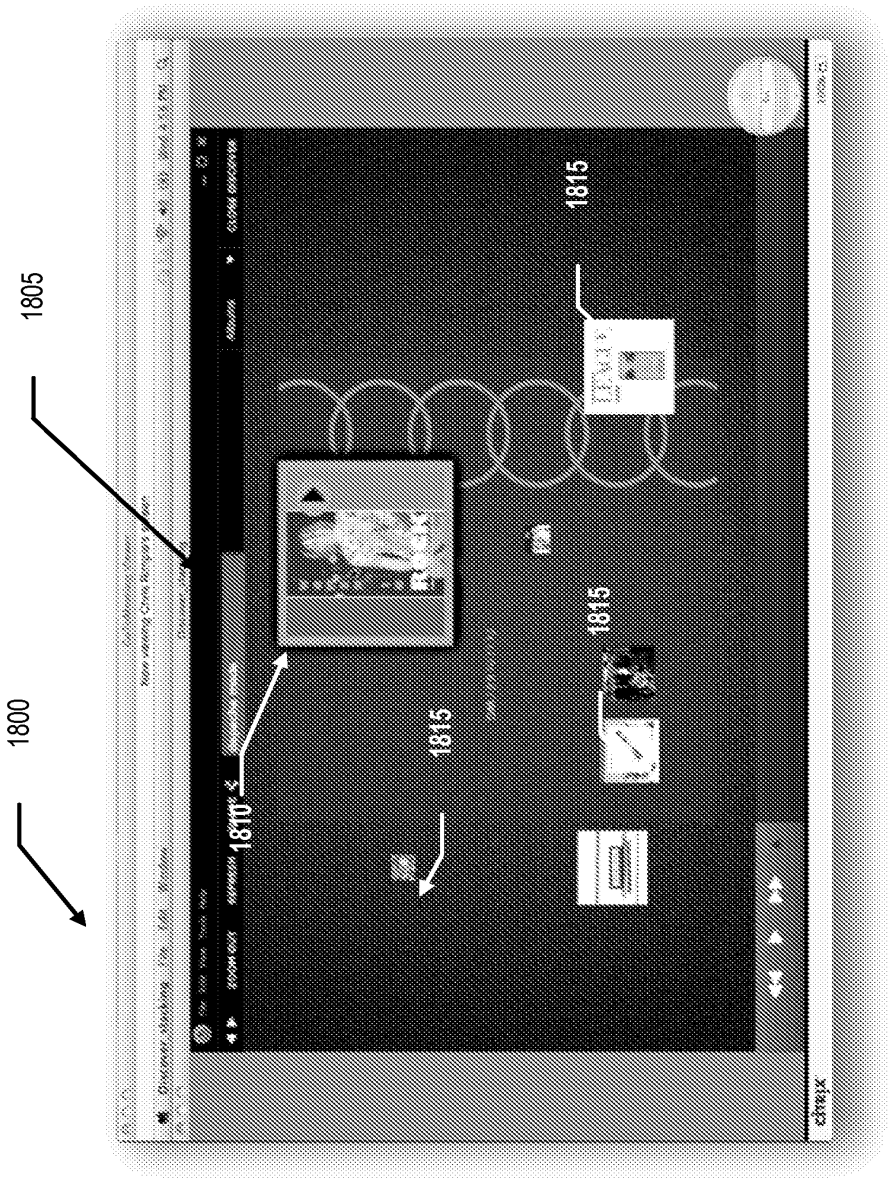


FIGURE 18a

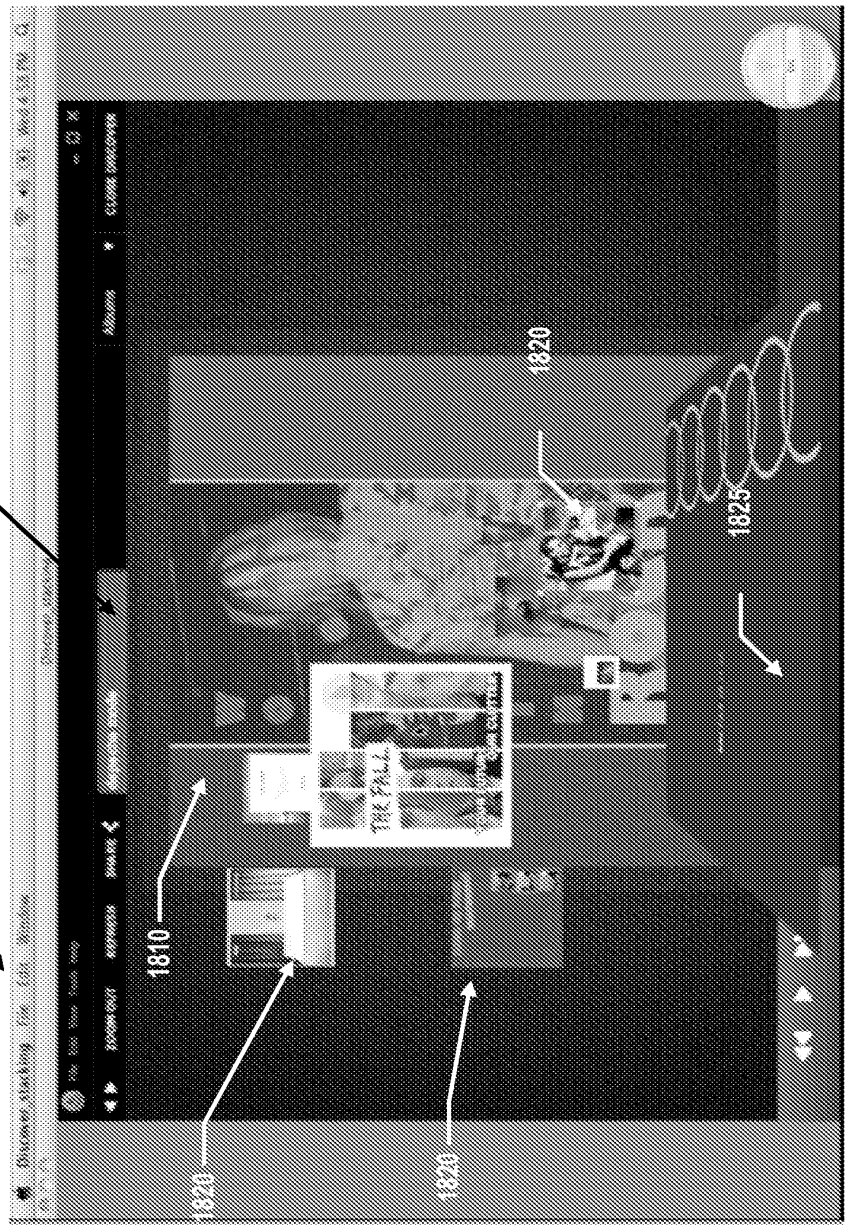


FIGURE 18b

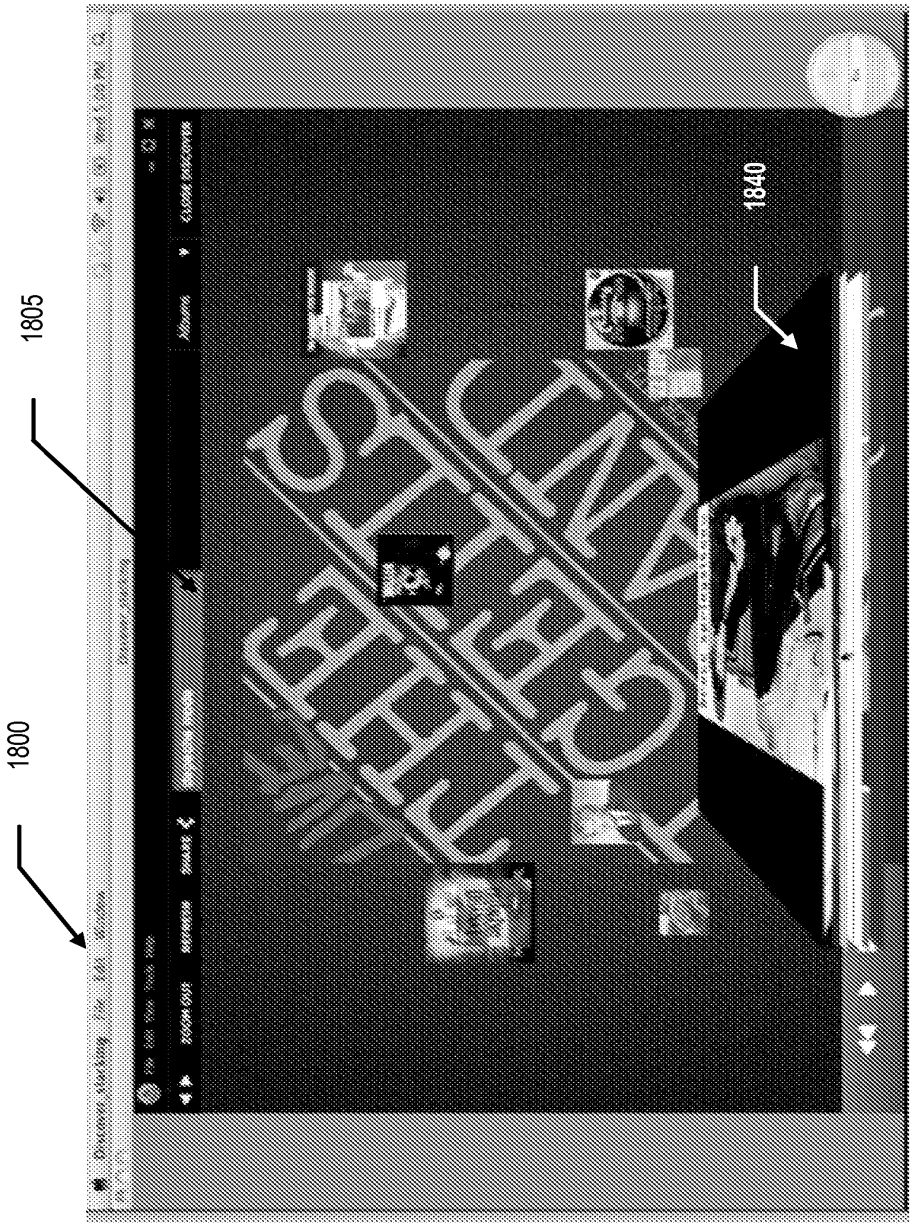


FIGURE 18c

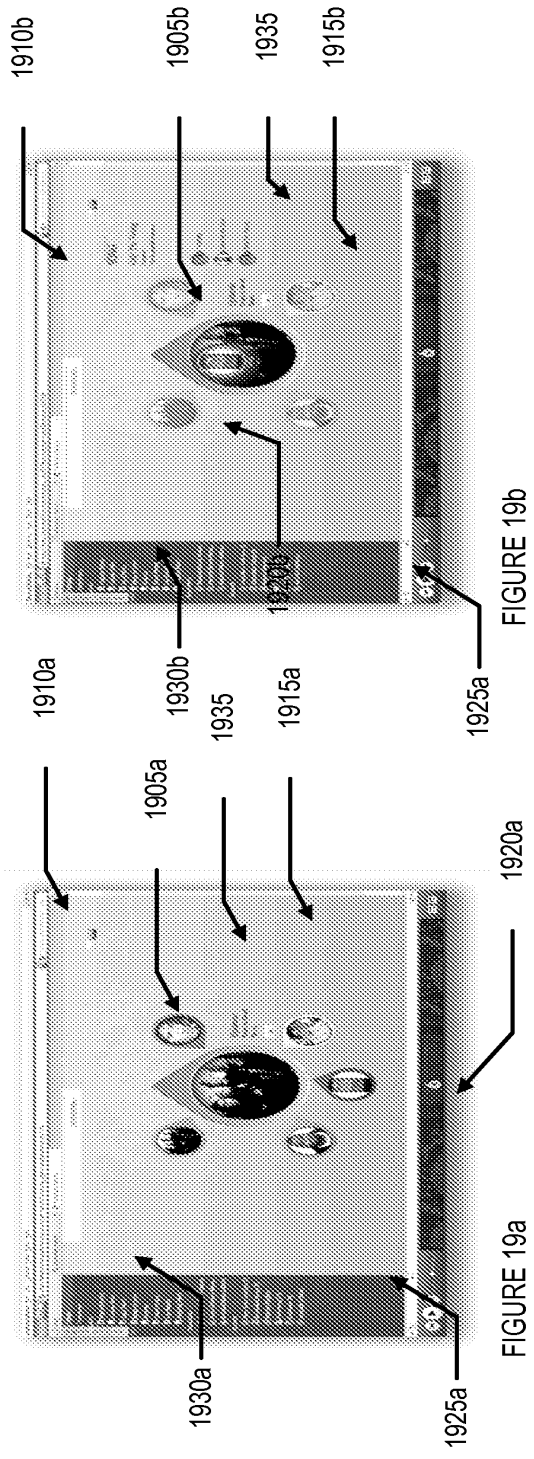


FIGURE 19a

FIGURE 19b

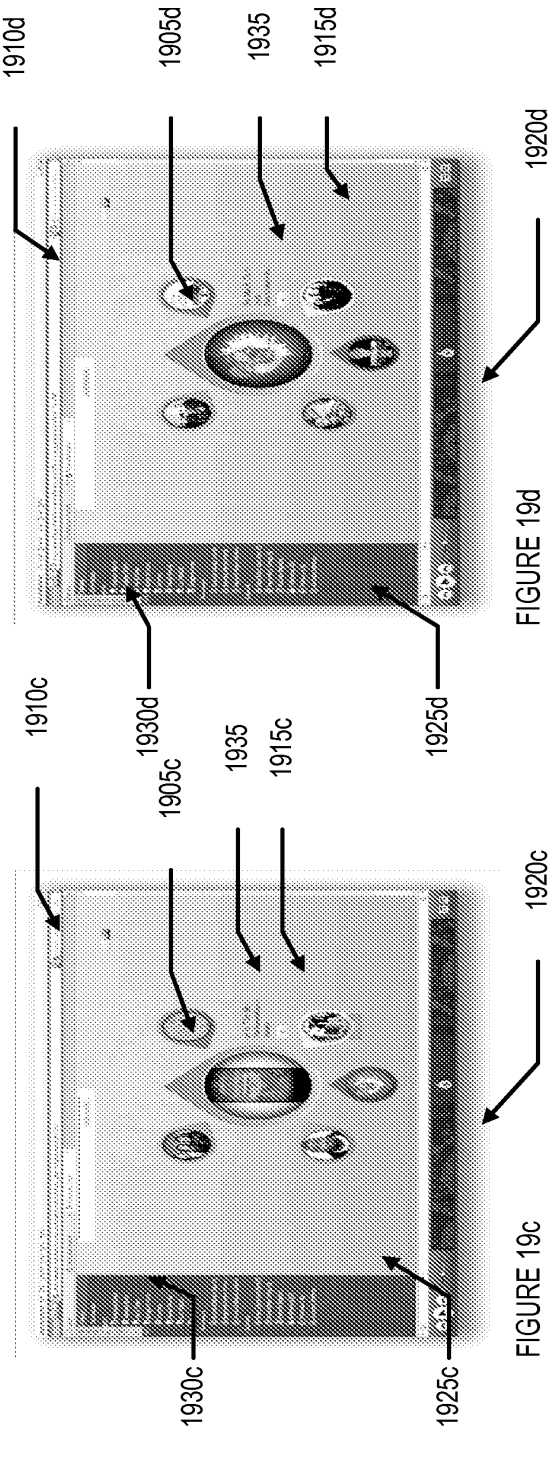


FIGURE 19c

FIGURE 19d

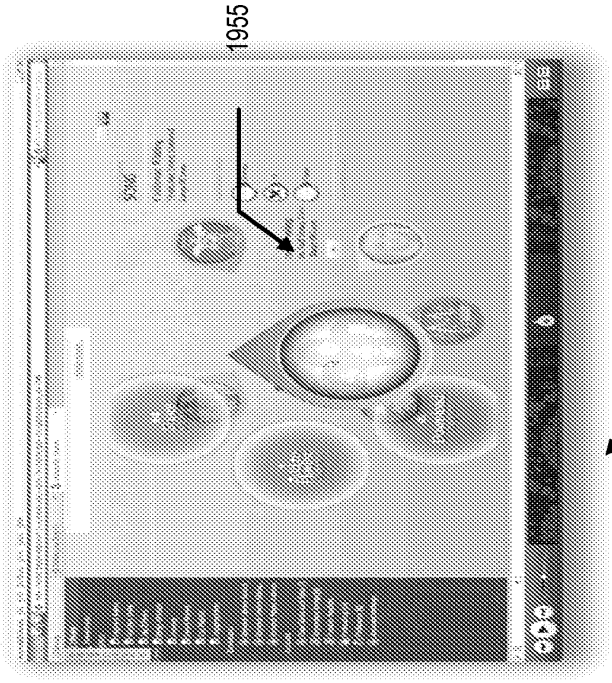


FIGURE 19f

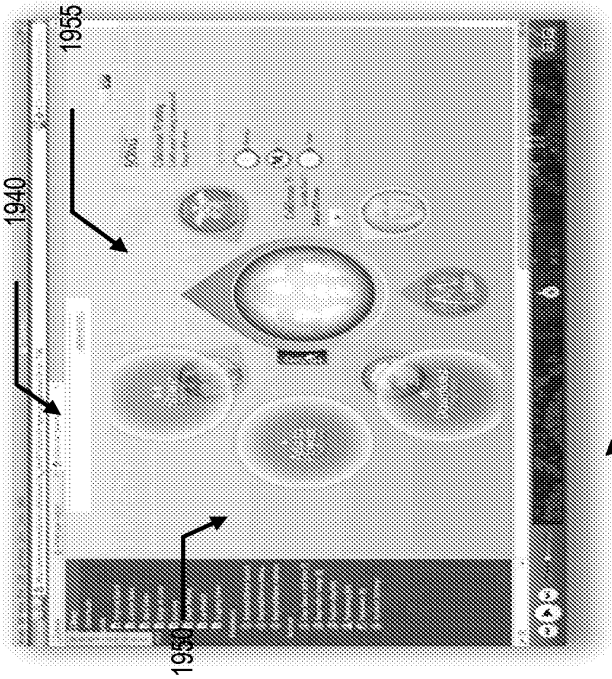


FIGURE 19e

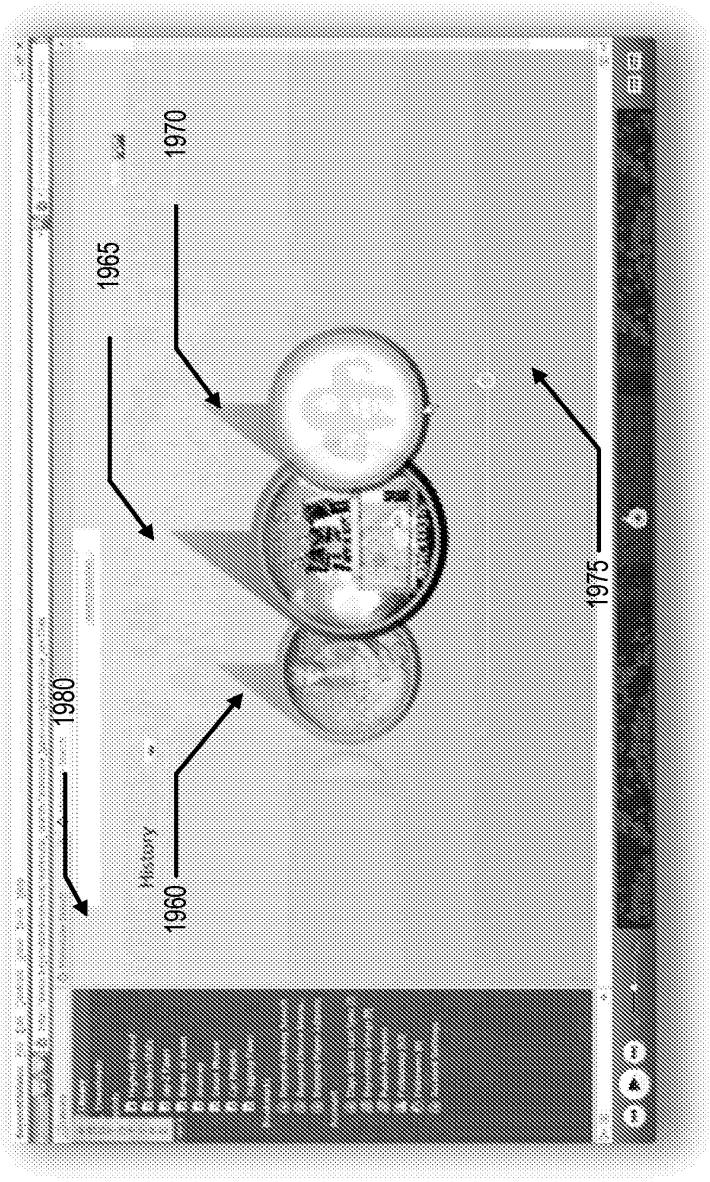


FIGURE 19g

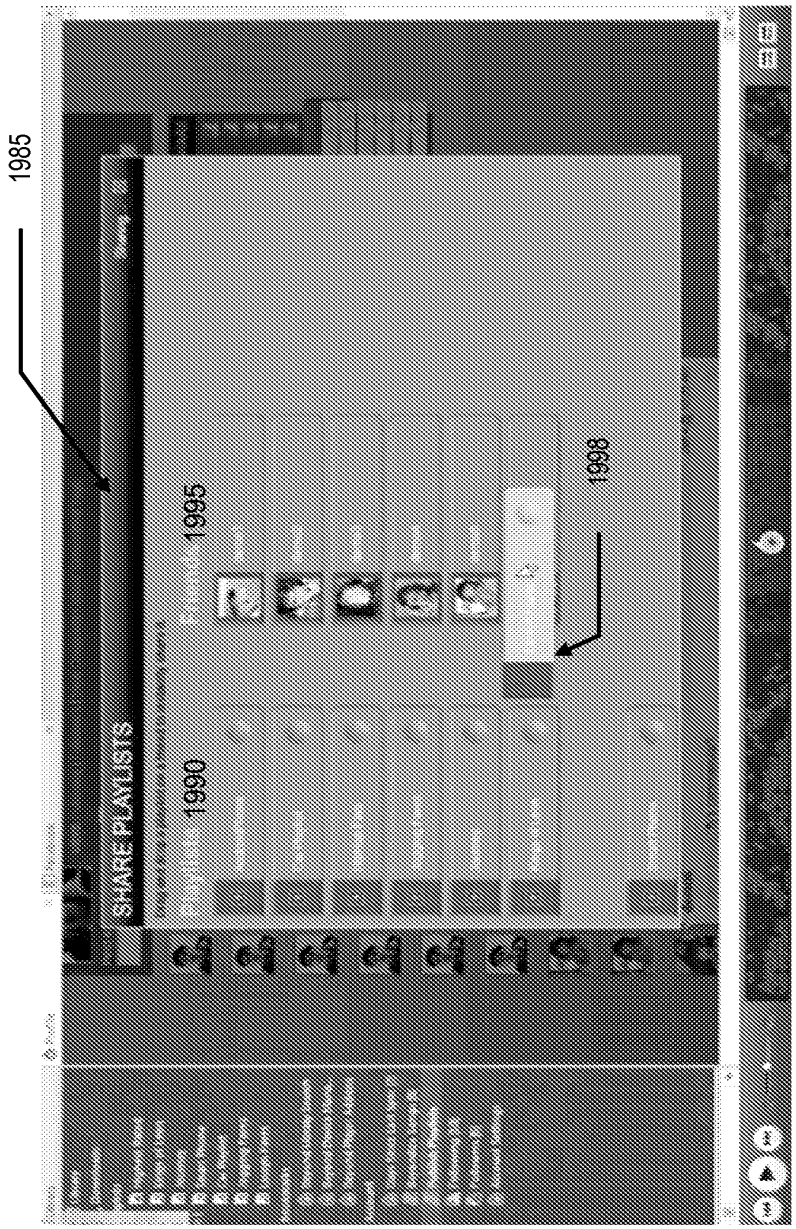


FIGURE 19h

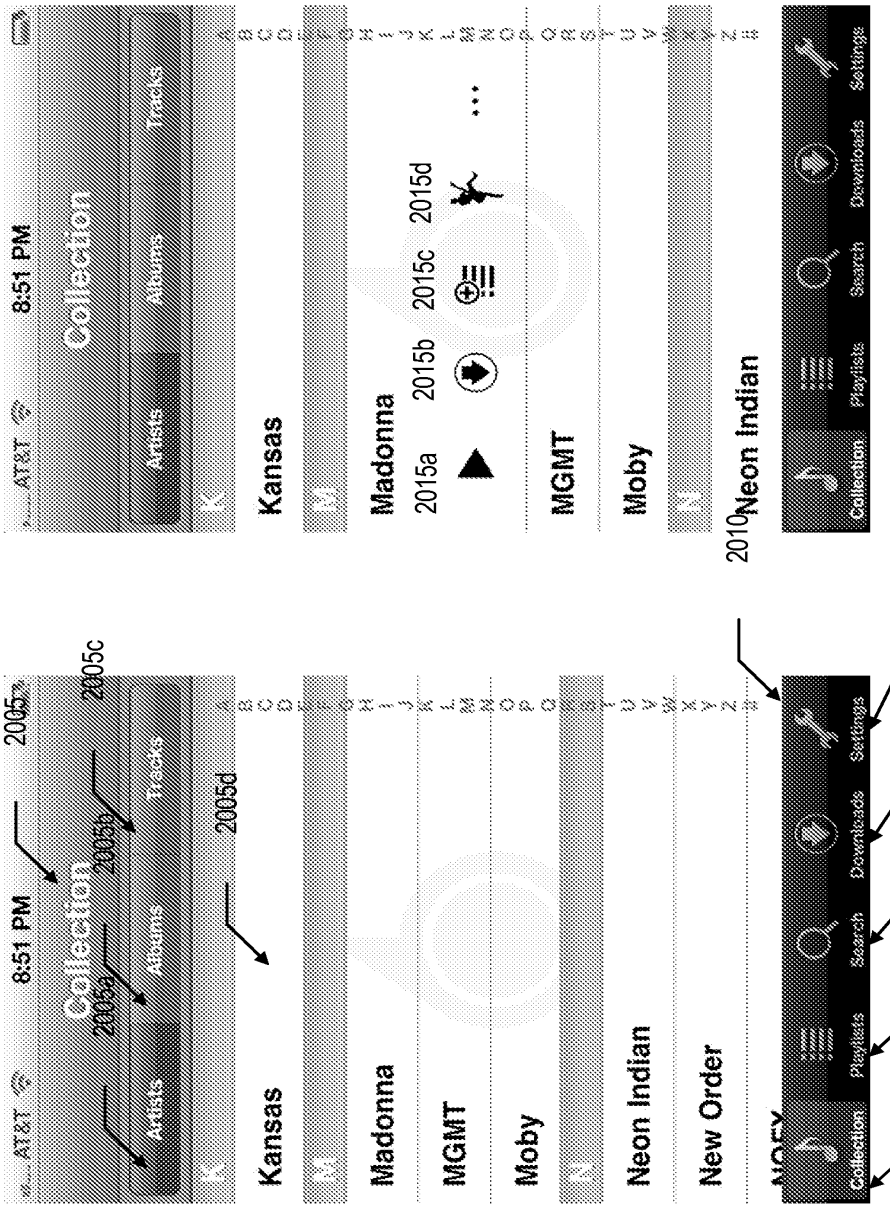


FIGURE 20a

FIGURE 20b

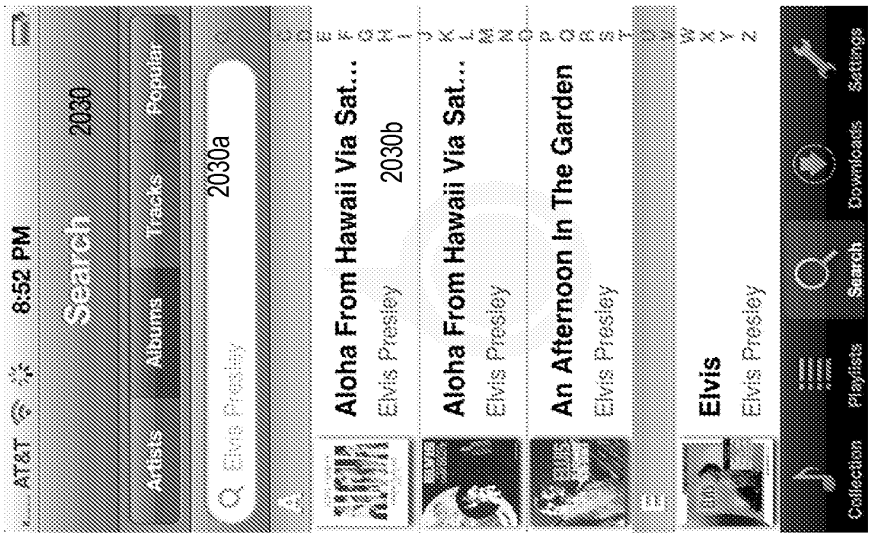


FIGURE 20d

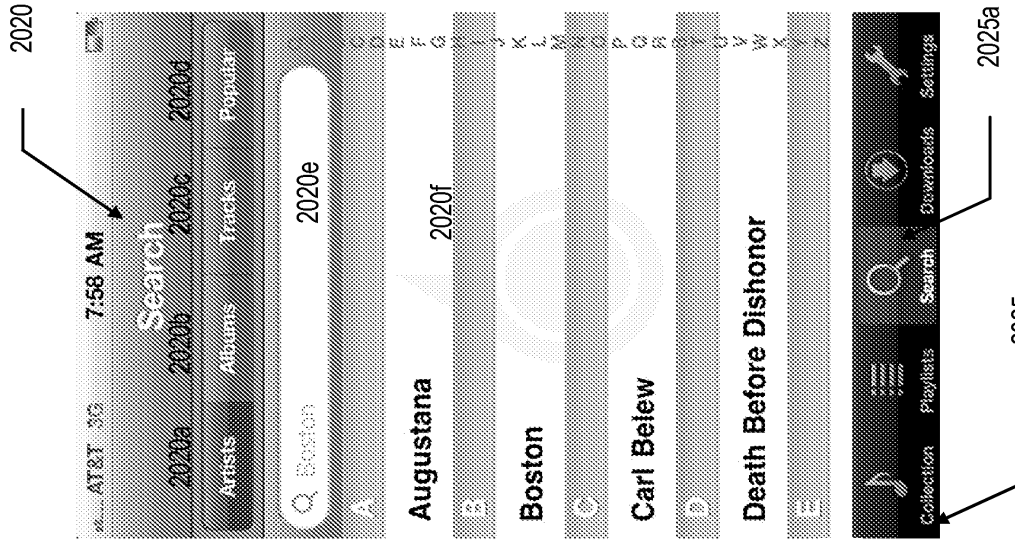


FIGURE 20c

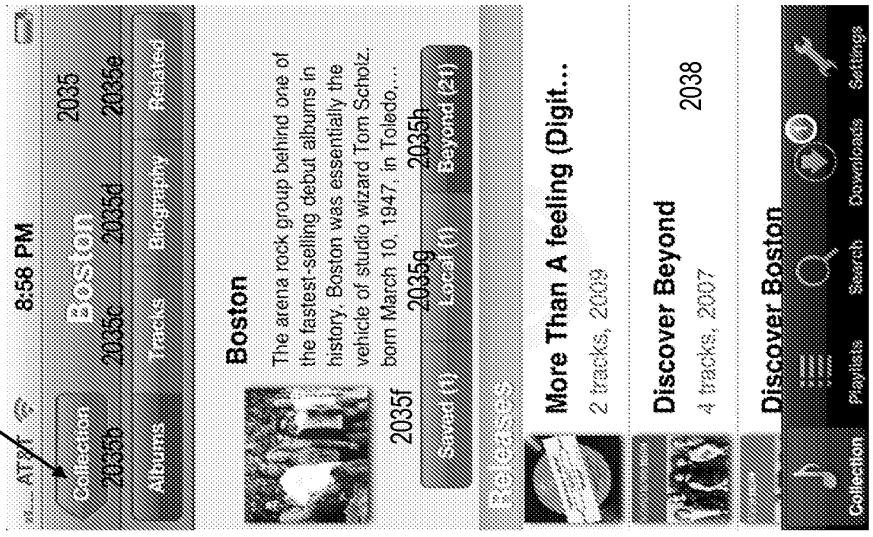


FIGURE 20e

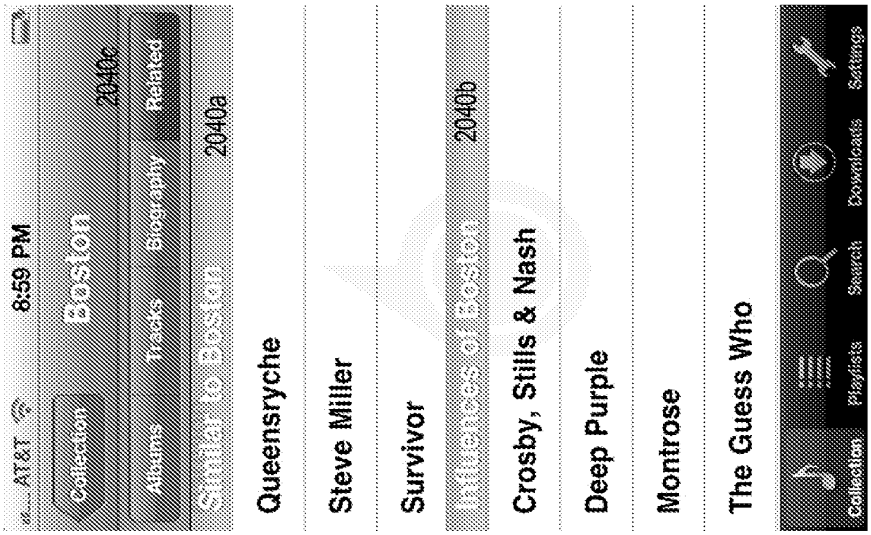


FIGURE 20f

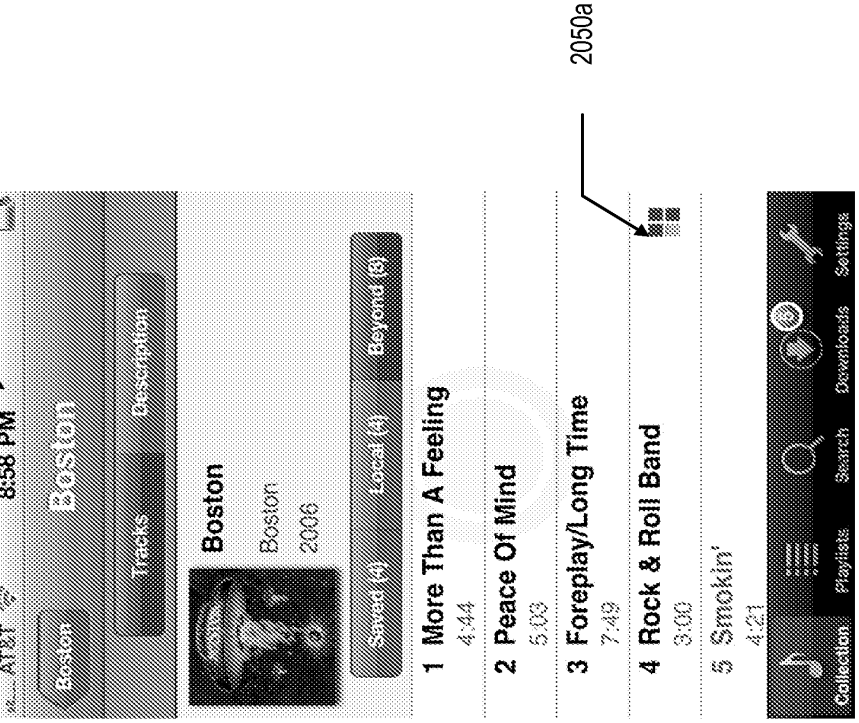


FIGURE 20h

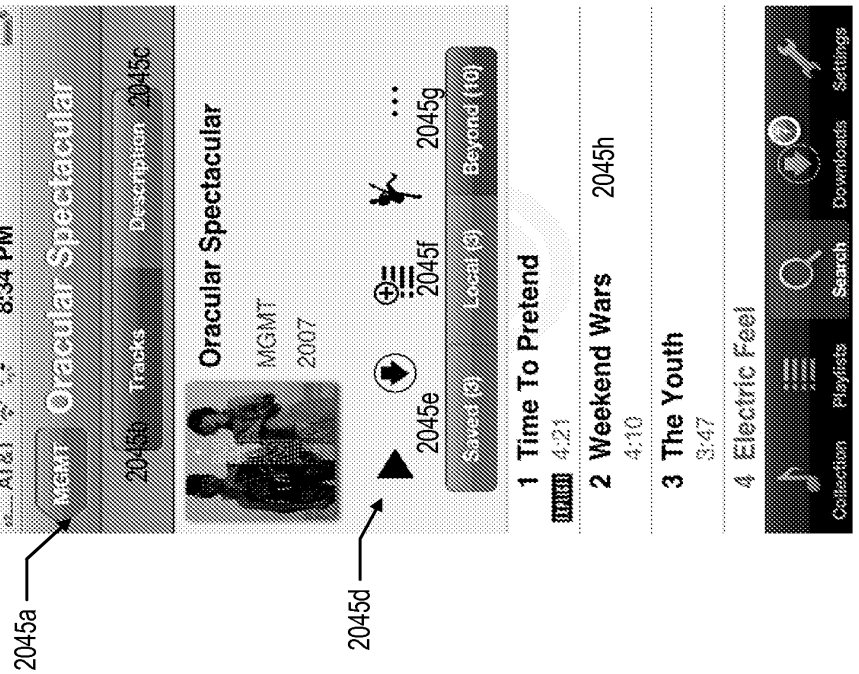


FIGURE 20g

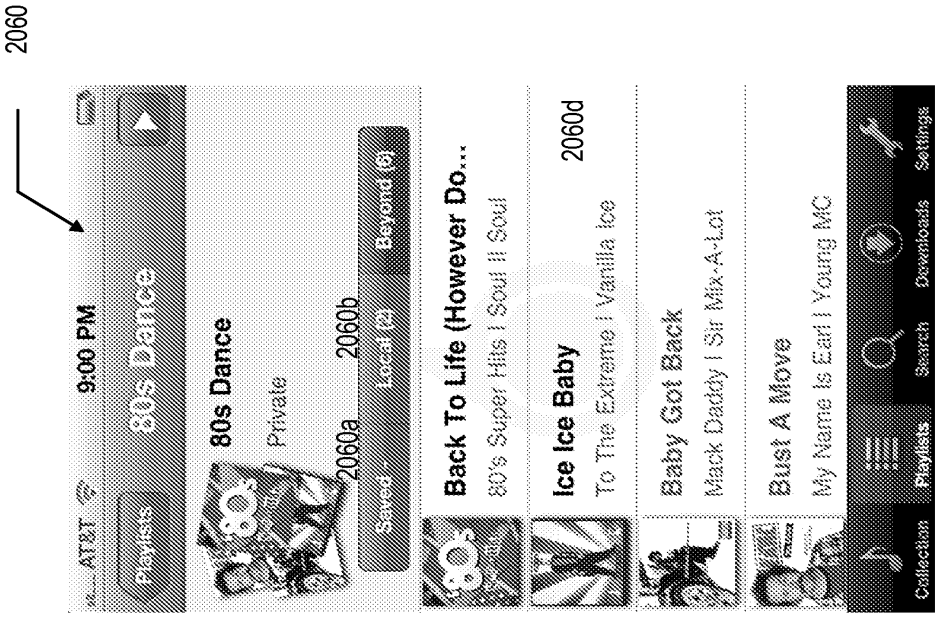


FIGURE 20j

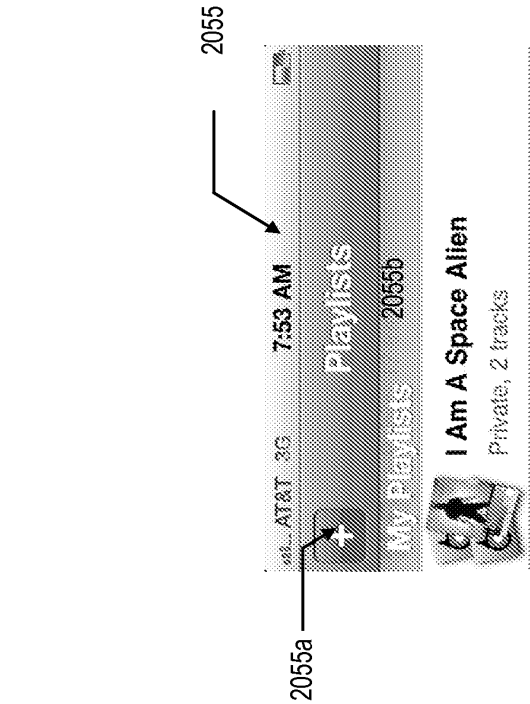


FIGURE 20i

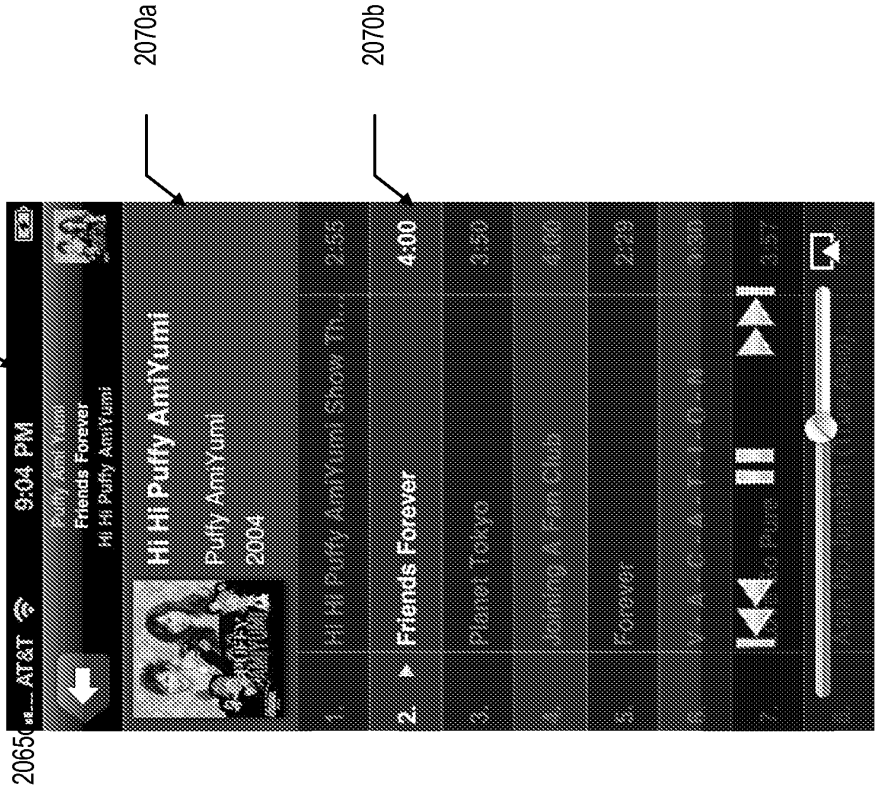
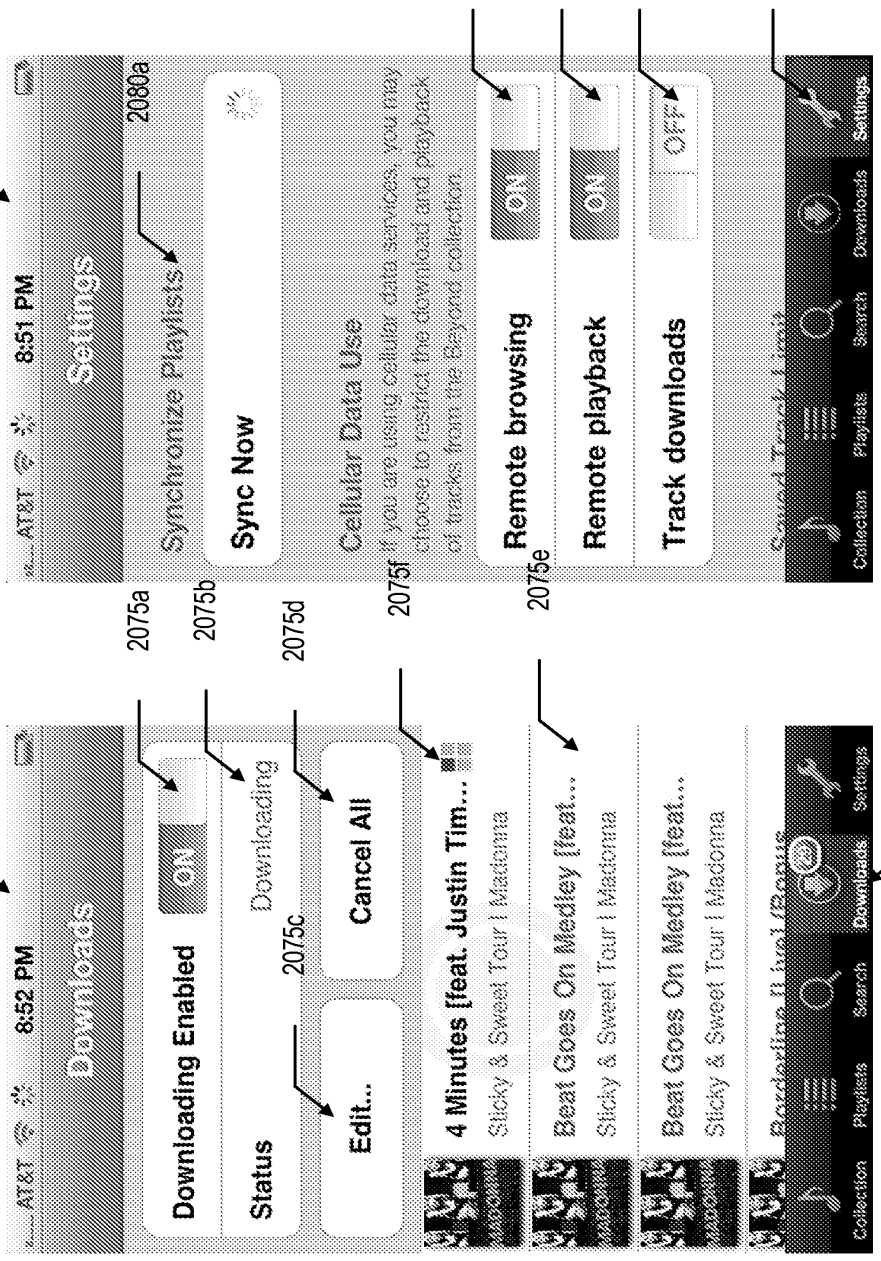


FIGURE 20l



FIGURE 20k


2075
AT&T
8:52 PM
Downloads
Downloading Enabled
ON
Status
Downloading
Edit...
Cancel All
4 Minutes [feat. Justin Tim...
Sticky & Sweet Tour | Madonna
Beat Goes On Medley [feat...
Sticky & Sweet Tour | Madonna
Beat Goes On Medley [feat...
Sticky & Sweet Tour | Madonna
Collection
Playlists
Search
Downloads
Settings
2075a
2075b
2075c
2075d
2075g
FIGURE 20m
2080
AT&T
8:51 PM
Settings
Synchronize Playlists
Sync Now
Cellular Data Use
If you are using cellular data services, you may choose to restrict the download and playback of tracks from the Beyond collection.
Remote browsing
ON
Remote playback
ON
Track downloads
OFF
Collection
Playlists
Search
Downloads
Settings
2080a
2075f
2075e
2080b
2080c
2080d
2080e
FIGURE 20n

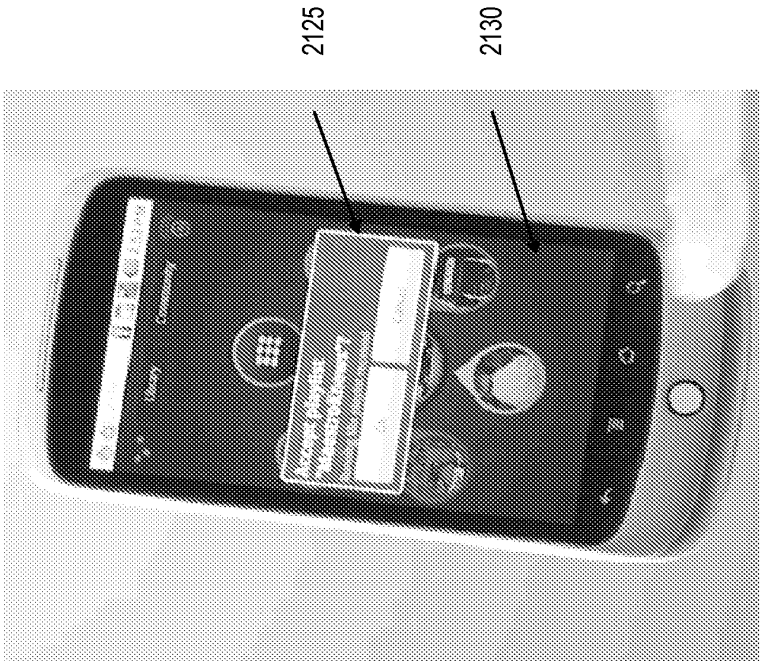


FIGURE 21b

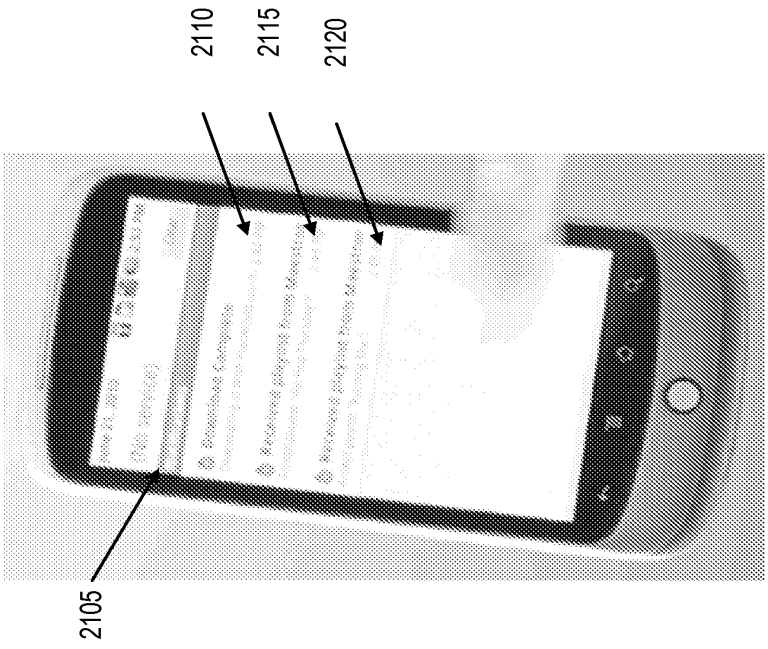


FIGURE 21a

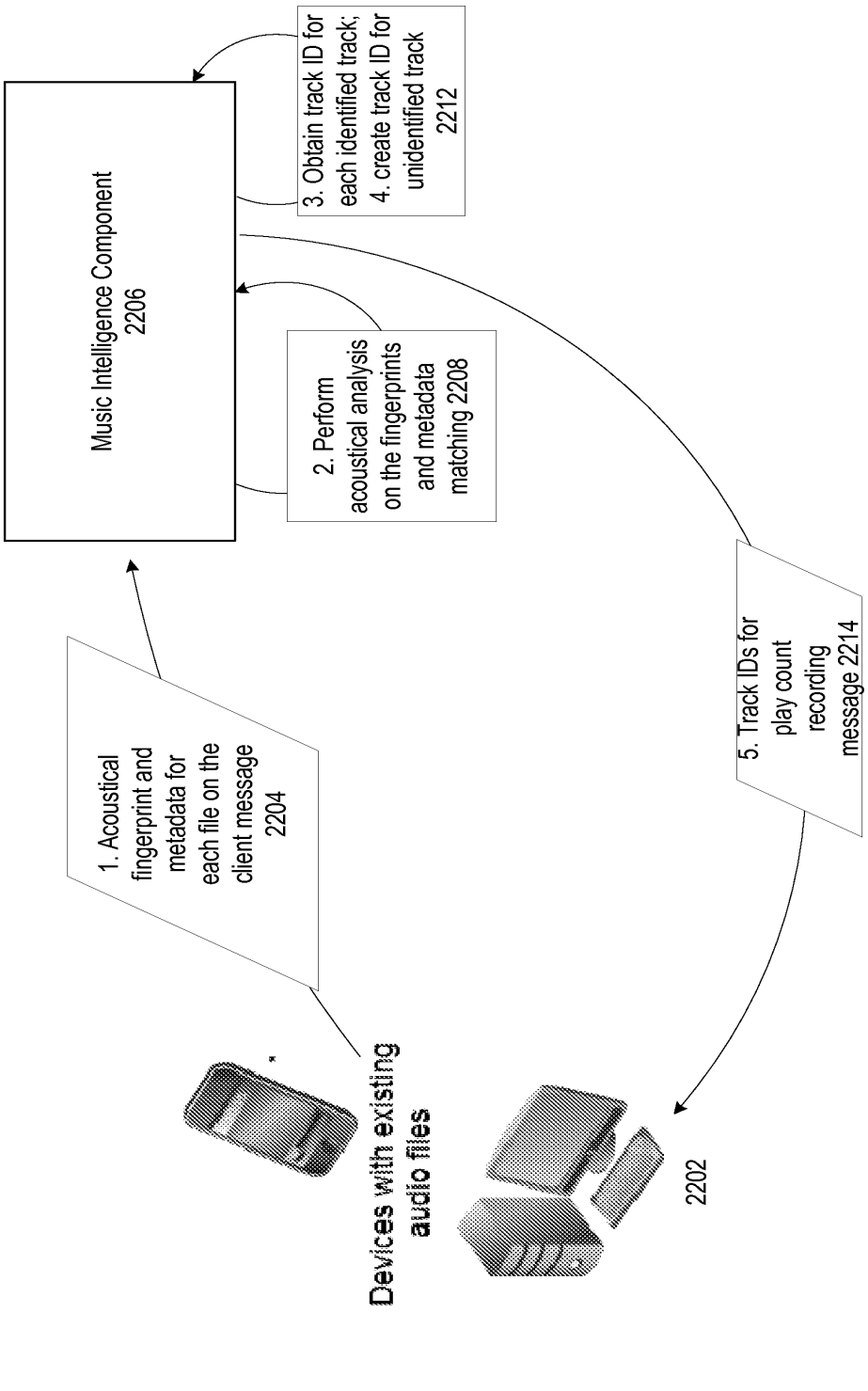

Music Intelligence Component
2206
3. Obtain track ID for each identified track; 4. create track ID for unidentified track 2212
2. Perform acoustical analysis on the fingerprints and metadata matching 2208
1. Acoustical fingerprint and metadata for each file on the client message 2204
5. Track IDs for play count recording message 2214
Devices with existing audio files
2202

FIGURE 22a

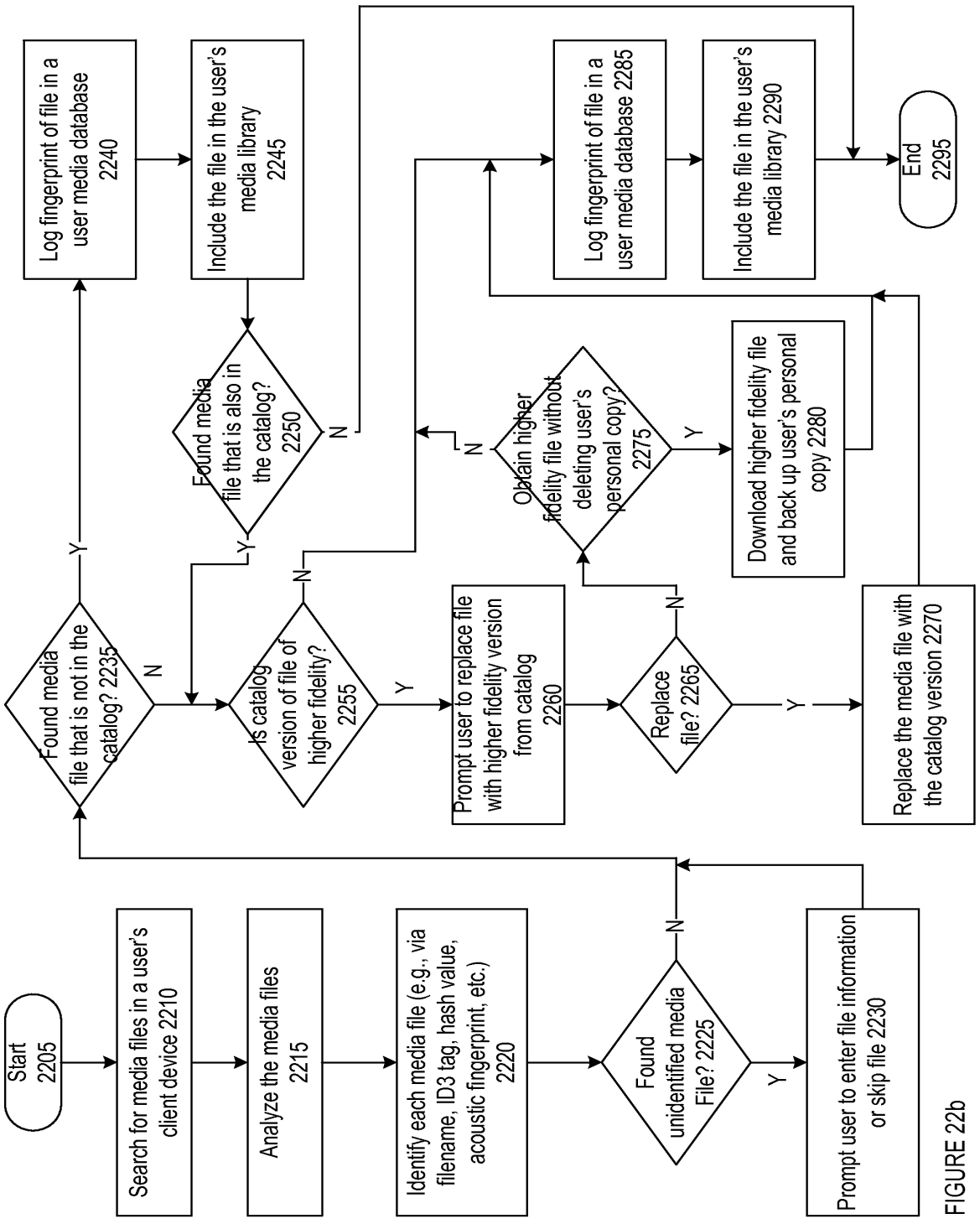

Start 2205
Search for media files in a user's client device 2210
Analyze the media files 2215
Identify each media file (e.g., via filename, ID3 tag, hash value, acoustic fingerprint, etc.) 2220
Found unidentified media File? 2225
Y
N
Prompt user to enter file information or skip file 2230
Found media file that is not in the catalog? 2235
Y
N
Log fingerprint of file in a user media database 2240
Include the file in the user's media library 2245
Found media file that is also in the catalog? 2250
Y
N
Is catalog version of file of higher fidelity? 2255
Y
N
Prompt user to replace file with higher fidelity version from catalog 2260
Replace file? 2265
Y
N
Replace the media file with the catalog version 2270
Obtain higher fidelity file without deleting user's personal copy? 2275
Y
N
Download higher fidelity file and back up user's personal copy 2280
Log fingerprint of file in a user media database 2285
Include the file in the user's media library 2290
End 2295

FIGURE 22b

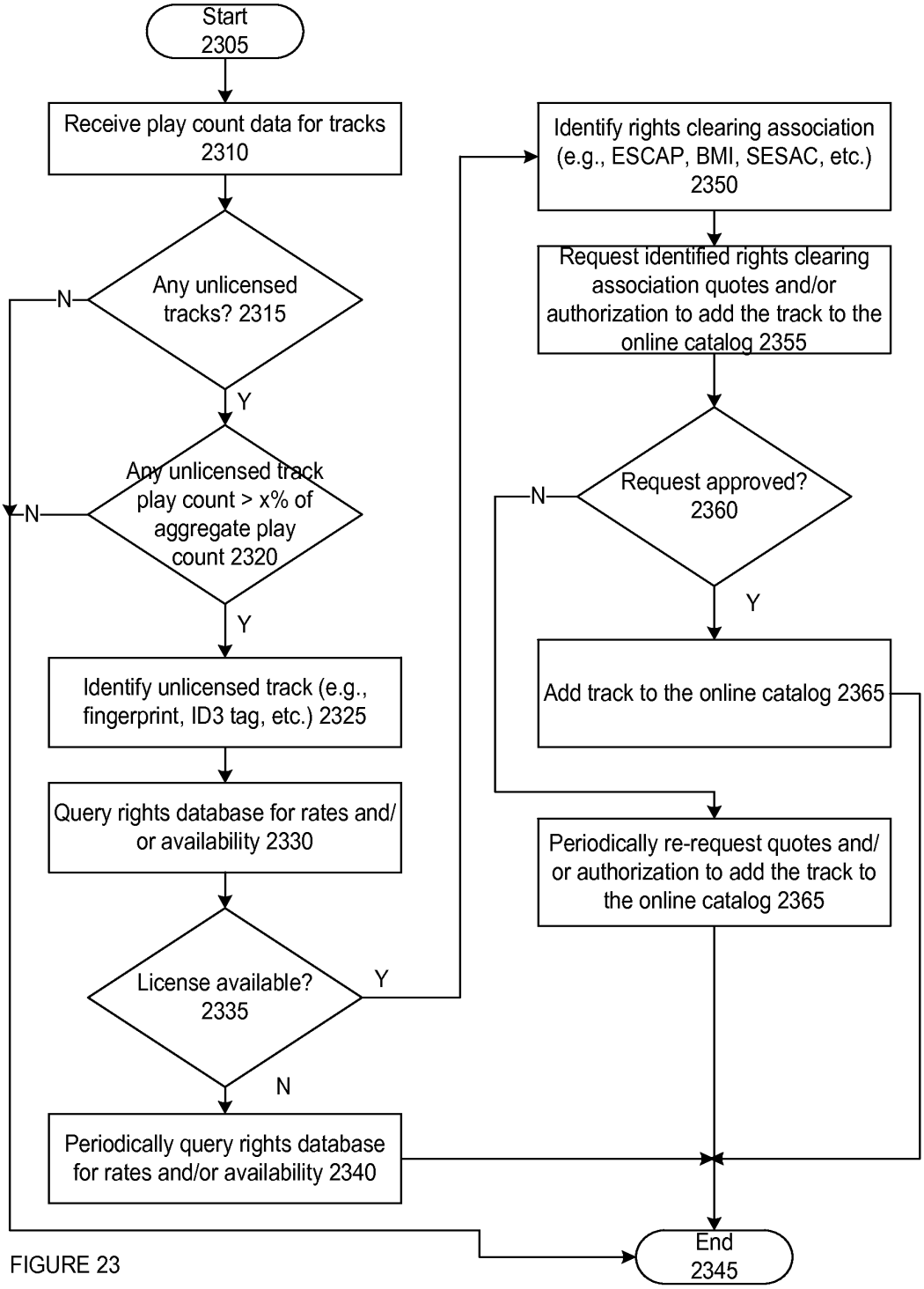

Start 2305
Receive play count data for tracks 2310
Any unlicensed tracks? 2315
N
Y
Any unlicensed track play count > x% of aggregate play count 2320
N
Y
Identify unlicensed track (e.g., fingerprint, ID3 tag, etc.) 2325
Query rights database for rates and/or availability 2330
License available? 2335
Y
N
Periodically query rights database for rates and/or availability 2340
Identify rights clearing association (e.g., ESCAP, BMI, SESAC, etc.) 2350
Request identified rights clearing association quotes and/or authorization to add the track to the online catalog 2355
Request approved? 2360
N
Y
Add track to the online catalog 2365
Periodically re-request quotes and/or authorization to add the track to the online catalog 2365
End 2345

FIGURE 23

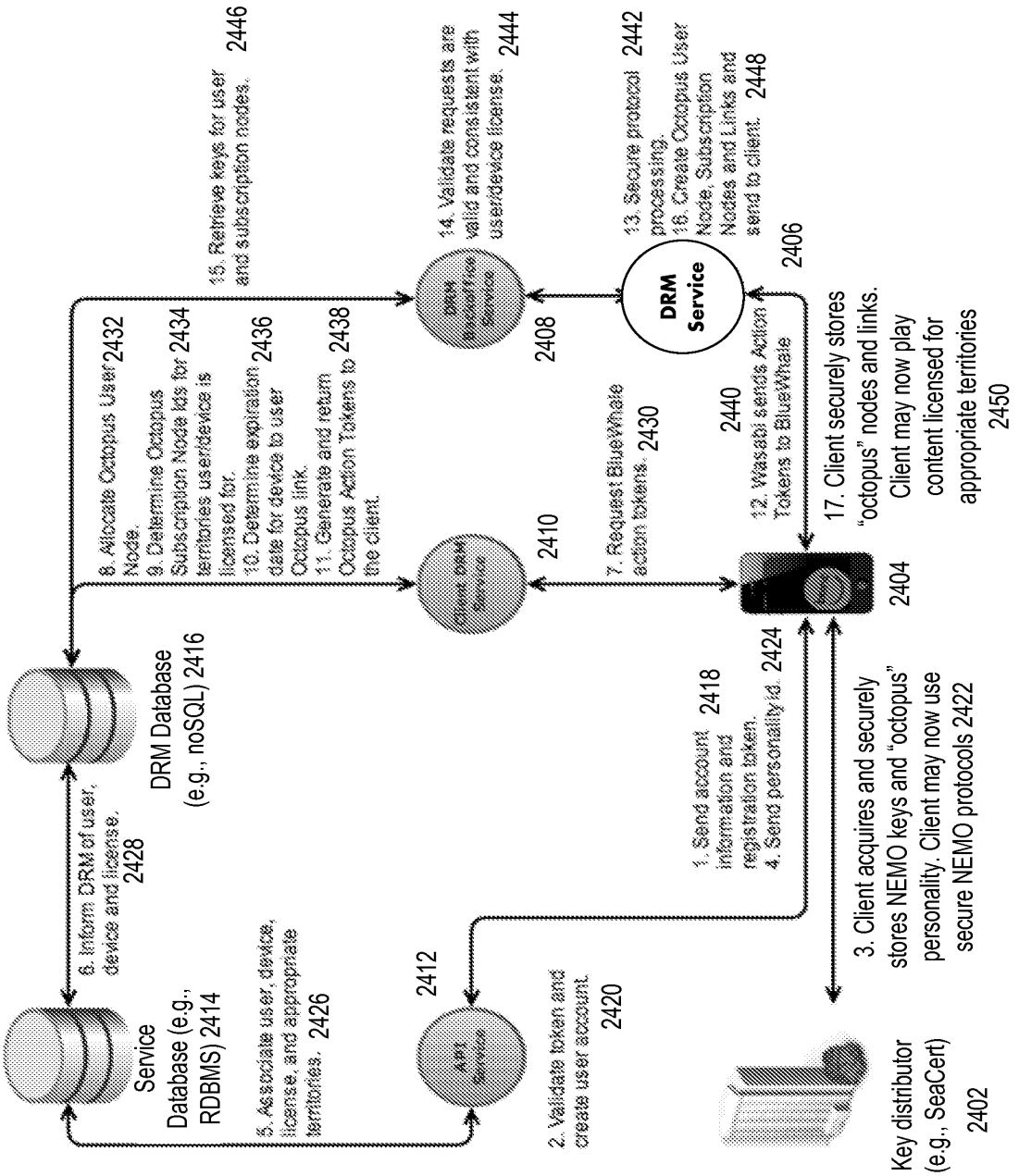

Service Database (e.g., RDBMS) 2414
DRM Database (e.g., noSQL) 2416
Key distributor (e.g., SeaCert) 2402
API Service
2412
Pixel push Service
2410
DRM Account Service
2408
DRM Service
2440
2404
2406
6. Inform DRM of user, device and license. 2428
8. Allocate Octopus User Node. 2432
9. Determine Octopus Subscription Node ids for territories user/device is licensed for. 2434
10. Determine expiration date for device to user Octopus link. 2436
11. Generate and return Octopus Action Tokens to the client. 2438
15. Retrieve keys for user and subscription nodes. 2446
14. Validate requests are valid and consistent with user/device license. 2444
13. Secure protocol processing. 2442
16. Create Octopus User Node, Subscription Nodes and Links and send to client. 2448
12. Wasabi sends Action Tokens to BlueWhale
17. Client securely stores "octopus" nodes and links. Client may now play content licensed for appropriate territories 2450
5. Associate user, device, license, and appropriate territories. 2426
7. Request BlueWhale action tokens. 2430
1. Send account information and registration token. 4. Send personality id. 2424
2418
2. Validate token and create user account. 2420
3. Client acquires and securely stores NEMO keys and "octopus" personality. Client may now use secure NEMO protocols 2422

FIGURE 24a

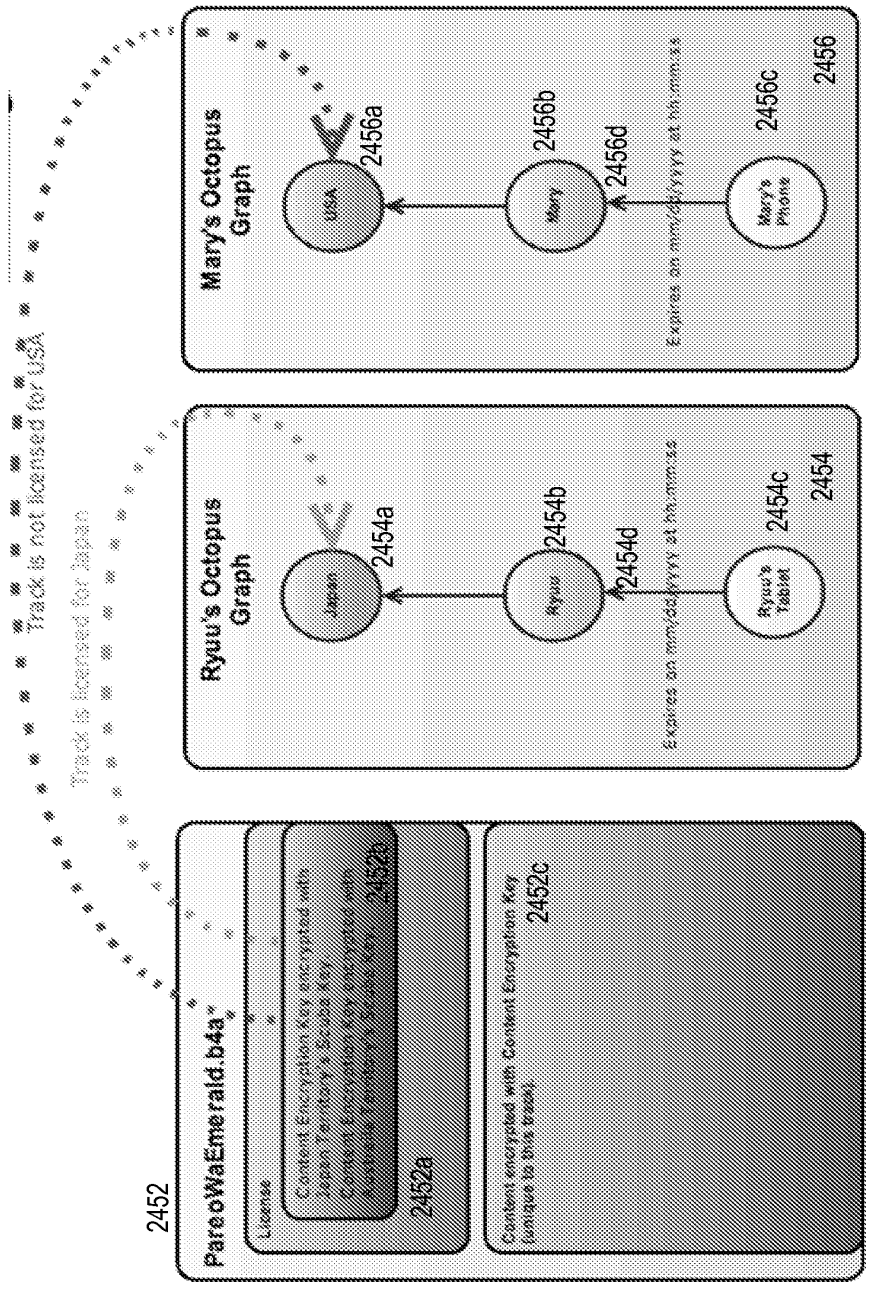

Track is not licensed for USA
Track is licensed for Japan
2452
PareoWaEmerald.b4a
License
Content Encryption Key encrypted with Japan Territory's Secret Key
2452b
2452a
Content encrypted with Content Encryption Key (unique to this track)
2452c
Ryuu's Octopus Graph
Japan
2454a
Ryuu
2454b
2454d
Ryuu's Tablet
2454c
2454
Expires on mm/dd/yyyy at hh:mm:ss
As long as the device to user link has not expired, client on Ryuu's phone may retrieve the Japan Territory's key, decrypt the content encryption key, and decrypt the track
Mary's Octopus Graph
USA
2456a
Mary
2456b
2456d
Mary's Phone
2456c
2456
Expires on mm/dd/yyyy at hh:mm:ss
Client on Mary's phone may not access the keys necessary to decrypt the track

FIGURE 24b

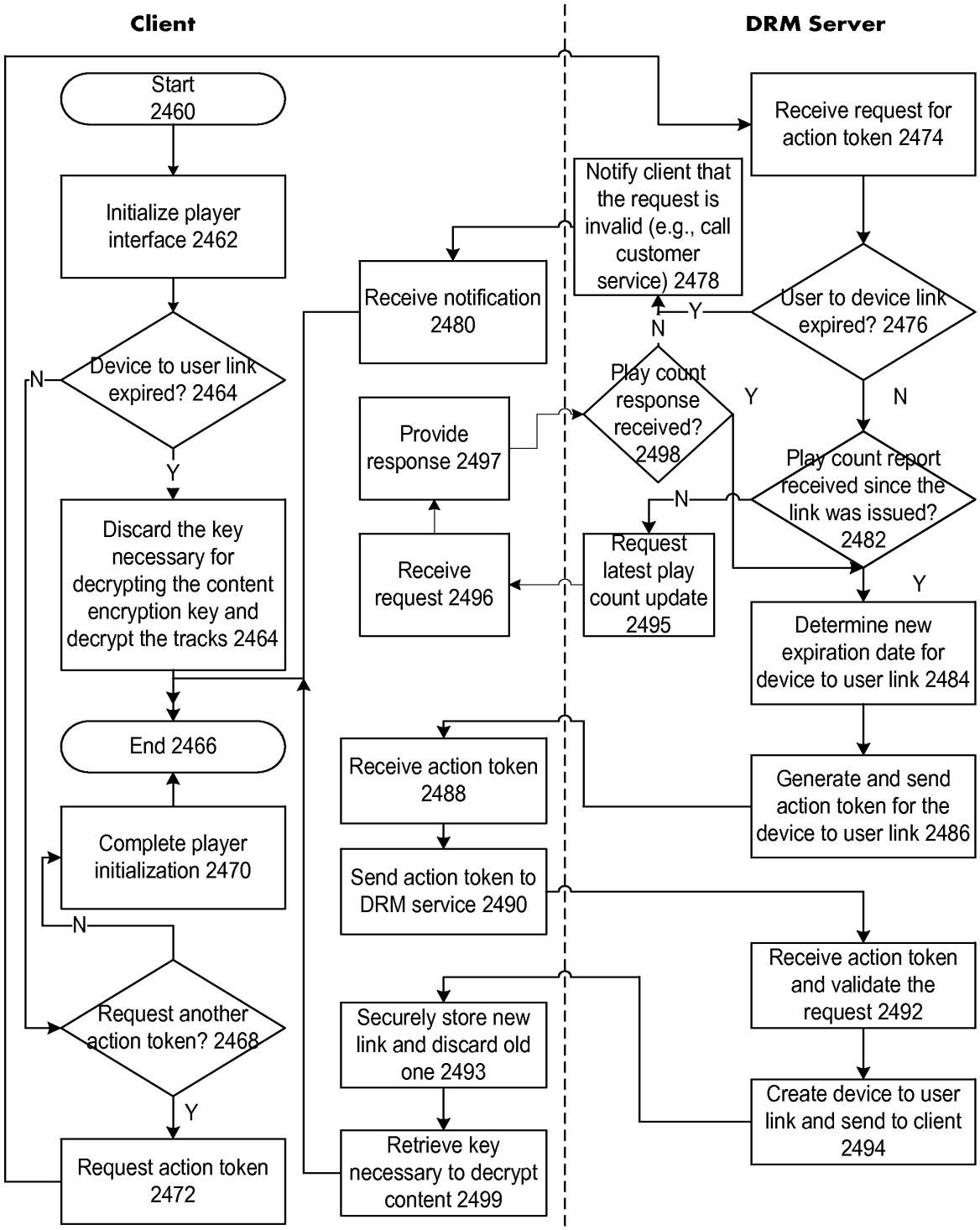

Client
DRM Server
Start 2460
Initialize player interface 2462
Device to user link expired? 2464
N
Y
Discard the key necessary for decrypting the content encryption key and decrypt the tracks 2464
End 2466
Complete player initialization 2470
N
Request another action token? 2468
Y
Request action token 2472
Receive notification 2480
Provide response 2497
Receive request 2496
Receive action token 2488
Send action token to DRM service 2490
Securely store new link and discard old one 2493
Retrieve key necessary to decrypt content 2499
Receive request for action token 2474
Notify client that the request is invalid (e.g., call customer service) 2478
User to device link expired? 2476
Y
N
Play count response received? 2498
Y
N
Request latest play count update 2495
Play count report received since the link was issued? 2482
N
Y
Determine new expiration date for device to user link 2484
Generate and send action token for the device to user link 2486
Receive action token and validate the request 2492
Create device to user link and send to client 2494

FIGURE 24c

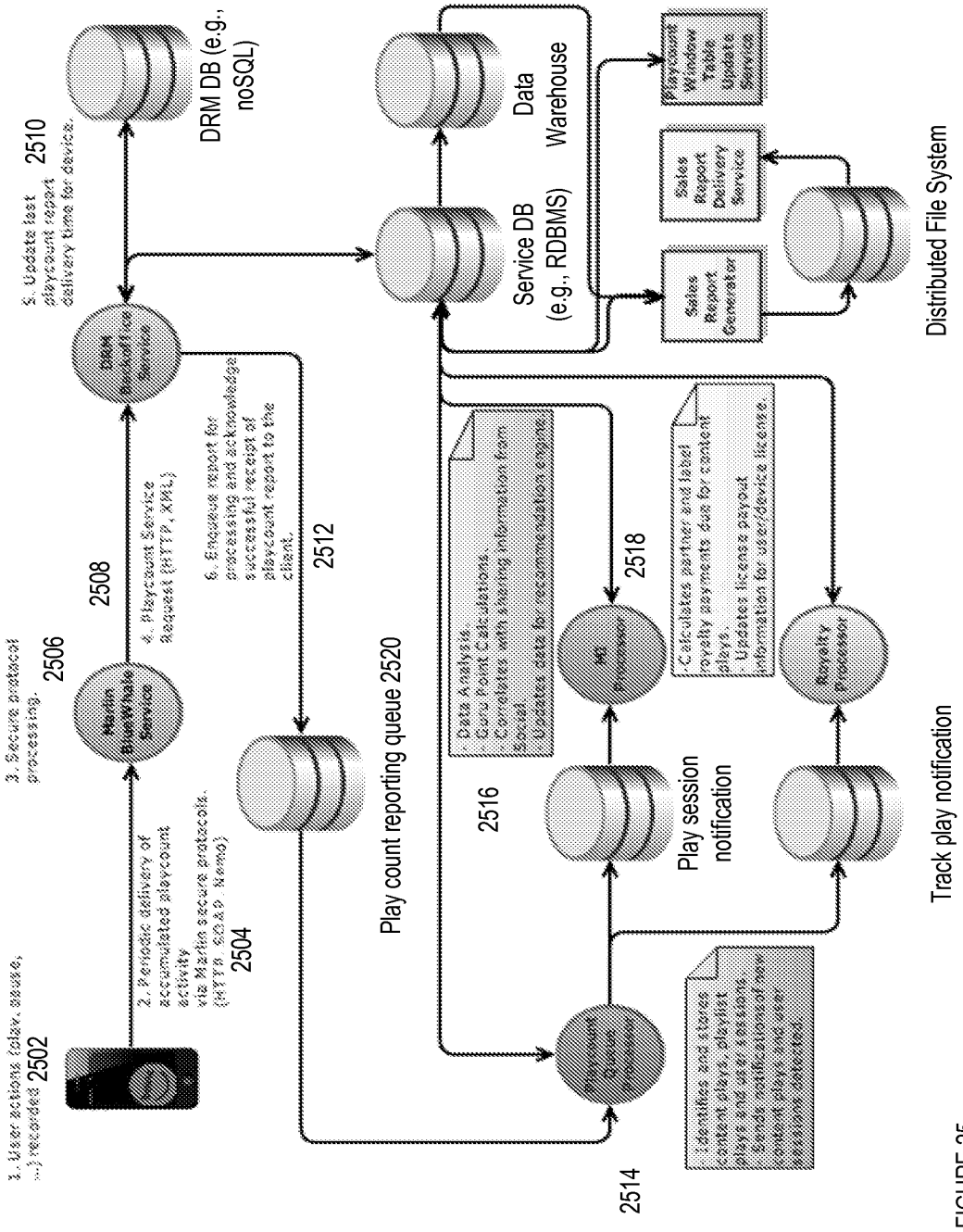

1. User actions (play, pause, ...) recorded 2502
2. Periodic delivery of accumulated playcount activity via Martin secure protocols. (HTTP, SOAP, Kerio) 2504
3. Secure protocol processing. 2506
Martin Block/Rule Service
2508
4. Playcount Service Request (HTTP, XML)
5. Update last playcount report delivery time for device. 2510
DRM Playcount Service
6. Enqueue report for processing and acknowledge successful receipt of playcount report to the client. 2512
DRM DB (e.g., noSQL)
Service DB (e.g., RDBMS)
Data Warehouse
Sales Report Generator
Sales Report Delivery Service
Playcount Window Table Update Service
Distributed File System
Play count reporting queue 2520
Data Analysis, Core Point Calculations, Correlates with earning information from social updates, calls for recommendation engine
2516
2518
Calculates partner and label royalty payments due for content plays. Updates license payout information for user/device license
Play session notification
Track play notification
2514
Identifies and stores content play, playlist plays and user sessions, sends notification of new content plays and user actions detected

FIGURE 25

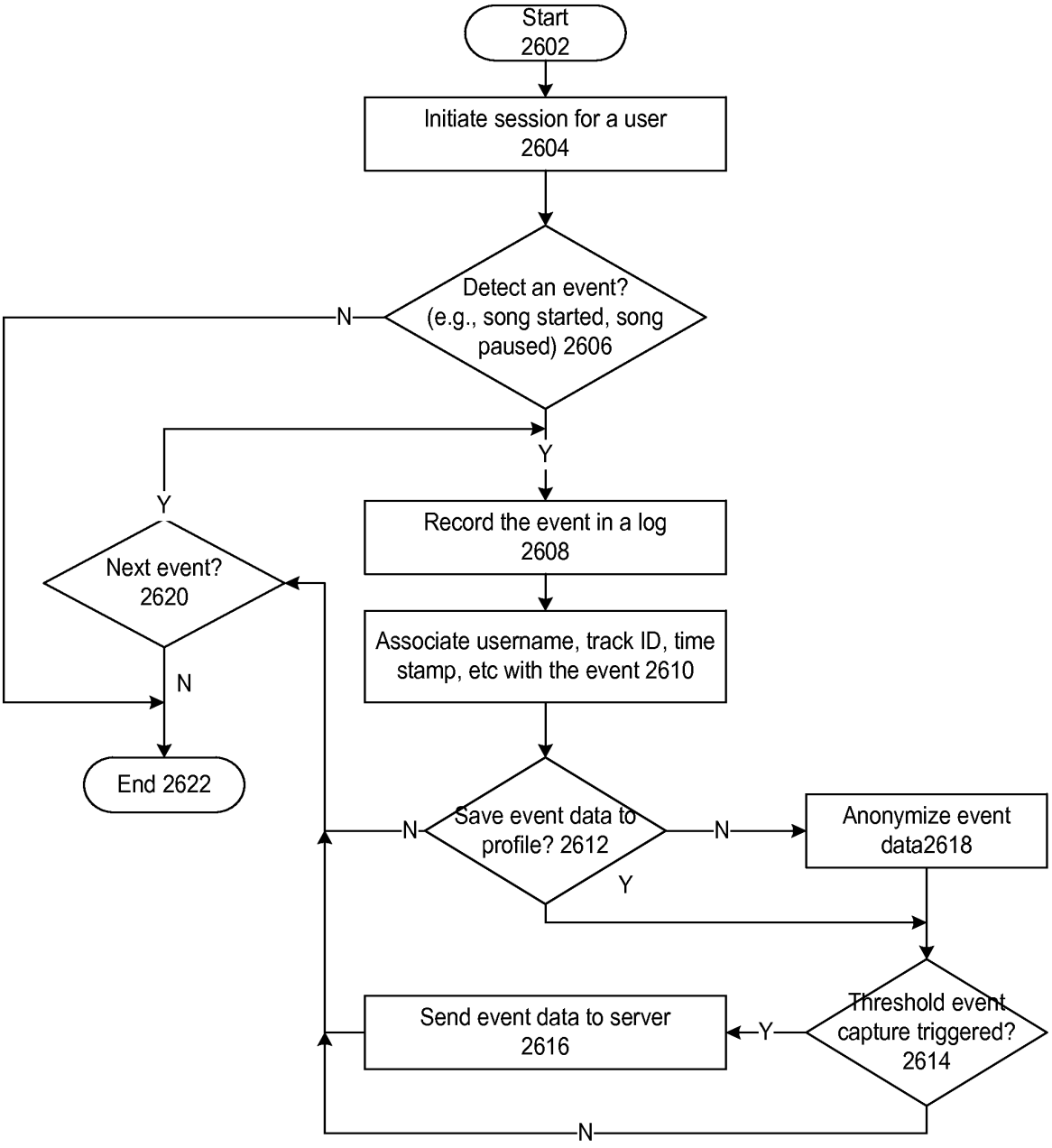

Start
2602
Initiate session for a user
2604
Detect an event?
(e.g., song started, song
paused) 2606
N
Y
Y
Record the event in a log
2608
Next event?
2620
Associate username, track ID, time
stamp, etc with the event 2610
N
End 2622
Save event data to
profile? 2612
N
N
Anonymize event
data2618
Y
Threshold event
capture triggered?
2614
Y
Send event data to server
2616
N

FIGURE 26a

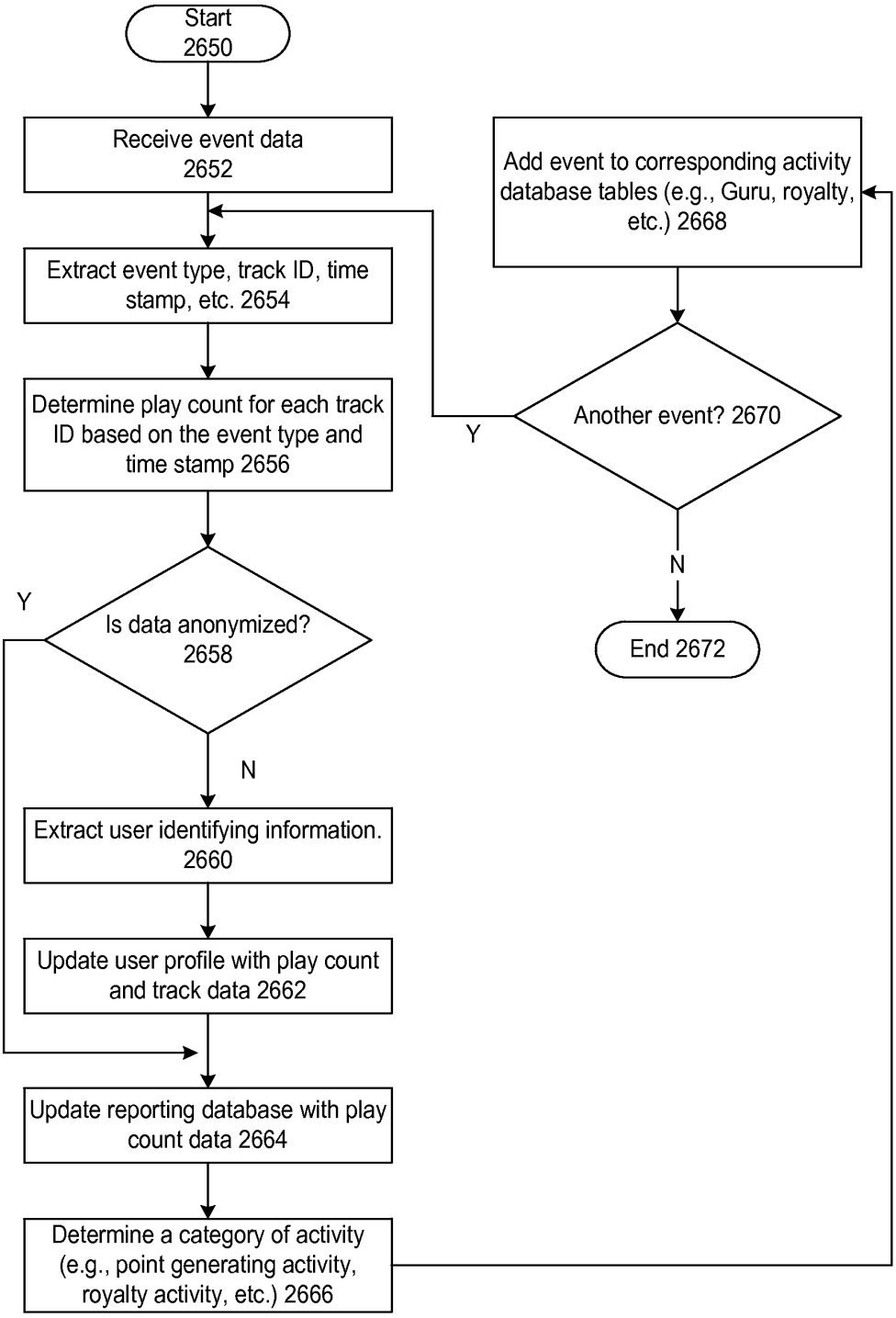

Start 2650
Receive event data 2652
Extract event type, track ID, time stamp, etc. 2654
Determine play count for each track ID based on the event type and time stamp 2656
Is data anonymized? 2658
Y
N
Extract user identifying information. 2660
Update user profile with play count and track data 2662
Update reporting database with play count data 2664
Determine a category of activity (e.g., point generating activity, royalty activity, etc.) 2666
Add event to corresponding activity database tables (e.g., Guru, royalty, etc.) 2668
Another event? 2670
Y
N
End 2672

FIGURE 26b

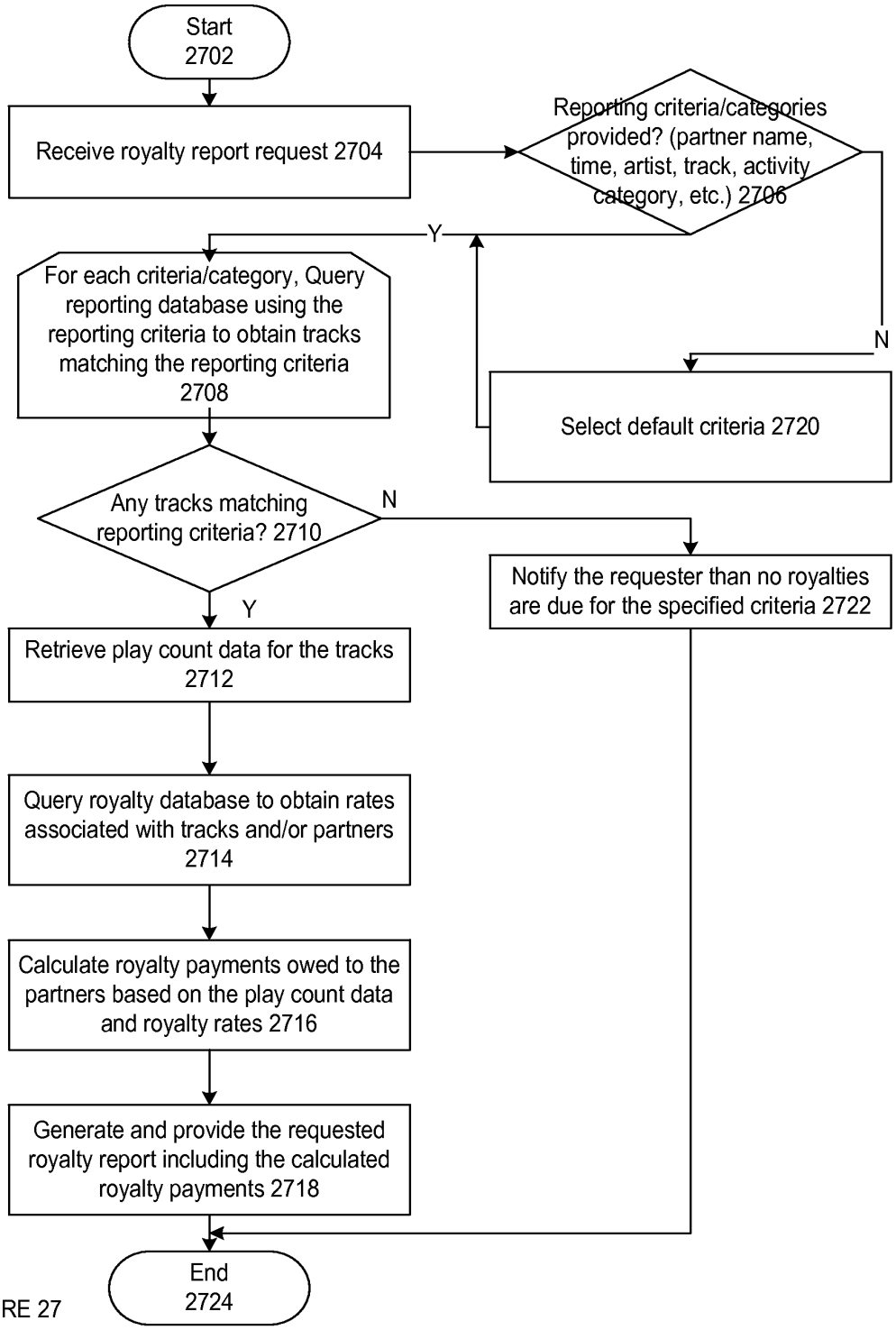
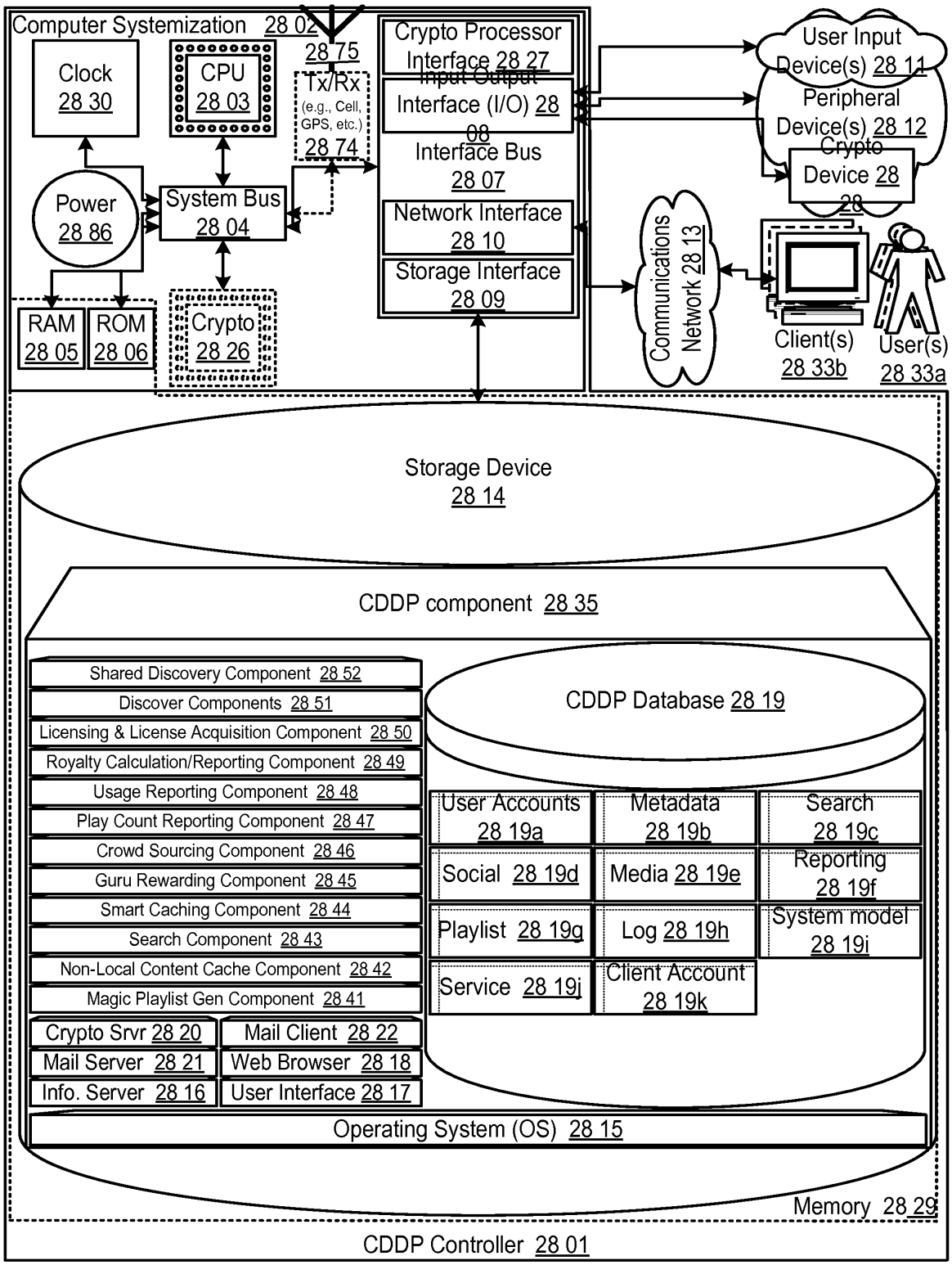

Start 2702
Receive royalty report request 2704
Reporting criteria/categories provided? (partner name, time, artist, track, activity category, etc.) 2706
Y
N
For each criteria/category, Query reporting database using the reporting criteria to obtain tracks matching the reporting criteria 2708
Select default criteria 2720
Any tracks matching reporting criteria? 2710
N
Y
Notify the requester than no royalties are due for the specified criteria 2722
Retrieve play count data for the tracks 2712
Query royalty database to obtain rates associated with tracks and/or partners 2714
Calculate royalty payments owed to the partners based on the play count data and royalty rates 2716
Generate and provide the requested royalty report including the calculated royalty payments 2718
End 2724

FIGURE 27


Computer Systemization 28 02
Clock 28 30
CPU 28 03
28 75
Tx/Rx (e.g., Cell, GPS, etc.) 28 74
Power 28 86
System Bus 28 04
RAM 28 05
ROM 28 06
Crypto 28 26
Crypto Processor Interface 28 27
Input Output Interface (I/O) 28 08
Interface Bus 28 07
Network Interface 28 10
Storage Interface 28 09
User Input Device(s) 28 11
Peripheral Device(s) 28 12
Crypto Device 28 28
Communications Network 28 13
Client(s) 28 33b
User(s) 28 33a
Storage Device 28 14
CDDP component 28 35
Shared Discovery Component 28 52
Discover Components 28 51
Licensing & License Acquisition Component 28 50
Royalty Calculation/Reporting Component 28 49
Usage Reporting Component 28 48
Play Count Reporting Component 28 47
Crowd Sourcing Component 28 46
Guru Rewarding Component 28 45
Smart Caching Component 28 44
Search Component 28 43
Non-Local Content Cache Component 28 42
Magic Playlist Gen Component 28 41
Crypto Srvr 28 20
Mail Client 28 22
Mail Server 28 21
Web Browser 28 18
Info. Server 28 16
User Interface 28 17
CDDP Database 28 19
User Accounts 28 19a
Metadata 28 19b
Search 28 19c
Social 28 19d
Media 28 19e
Reporting 28 19f
Playlist 28 19g
Log 28 19h
System model 28 19i
Service 28 19j
Client Account 28 19k
Operating System (OS) 28 15
Memory 28 29
CDDP Controller 28 01

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(54) Title: SYSTEMS, METHODS, APPARATUS, AND ARTICLES OF MANUFACTURE TO PROVIDE A CROWD-SOURCED PLAYLIST WITH GUEST ACCESS

(57) Abstract: Systems and methods are provided to offer a restricted playback mode playlist mode to allow one or more participating users to access a host's media playback system and interact with a reduced subset of functions in that system. An example method includes providing, via a local media playback system, a restricted playback mode open to a plurality of participating users, the restricted playback mode providing a subset of playback functions from the local media playback system to the participating users, the subset including addition of content to a playlist for playback via the local media playback system. The example method includes facilitating addition of content to the playlist by at least one participating user. The example method includes facilitating playback of content from the playlist in the restricted playback mode.

TITLE: SYSTEMS, METHODS, APPARATUS, AND ARTICLES OF MANUFACTURE TO PROVIDE A CROWD-SOURCED PLAYLIST WITH GUEST ACCESS

FIELD OF THE DISCLOSURE

[0001] The disclosure is related to consumer goods and, more particularly, to systems, products, features, services, and other items directed to media playback or some aspect thereof.

BACKGROUND

[0002] Technological advancements have increased the accessibility of music content, as well as other types of media, such as television content, movies, and interactive content. For example, a user can access audio, video, or both audio and video content over the Internet through an online store, an Internet radio station, a music service, a movie service, and so on, in addition to the more traditional avenues of accessing audio and video content. Demand for audio, video, and both audio and video content inside and outside of the home continues to increase.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Features, aspects, and advantages of the presently disclosed technology are better understood with regard to the following description, appended claims, and accompanying drawings where:

[0011] Figure 1 shows an illustration of an example system in which embodiments of the methods and apparatus disclosed herein can be implemented;

[0012] Figure 2A shows an illustration of an example zone player having a built-in amplifier and speakers;

[0013] Figure 2B shows an illustration of an example zone player having a built-in amplifier and connected to external speakers;

[0014] Figure 2C shows an illustration of an example zone player connected to an A/V receiver and speakers;

[0015] Figure 3 shows an illustration of an example controller;

[0016] Figure 4 shows an internal functional block diagram of an example zone player;

[0017] Figure 5 shows an internal functional block diagram of an example controller;

[0018] Figure 6 depicts an example shared listening zone group including multiple zones in which multiple users, via multiple controllers can control music played in the zone group via a plurality of media playback devices;

[0019] Figure 7 illustrates a flow diagram of an example method to implement a party playlist mode in a media playback system;

[0020] Figure 8 illustrates a flow diagram of an example method to facilitate addition of content to a party playlist.

[0021] Figures 9-15 illustrate example user interfaces facilitating content selection, playback and configuration in a party playlist mode.

[0022] In addition, the drawings are for the purpose of illustrating example embodiments, but it is understood that the present disclosure is not limited to the arrangements and instrumentality shown in the drawings.

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DETAILED DESCRIPTION

I. Overview

[0023] Listening to audio content out loud can be a social activity that involves family, friends, or both. Audio content may include, for instance, music, talk radio, books, audio from television, and other audible material. For example, in a household, people may play music out loud at parties and other social gatherings. In such an environment, people may wish to play the music in one listening zone or multiple listening zones simultaneously, such that the music in each listening zone may be synchronized, without audible echoes or glitches. Such an experience may be further enriched when people, for example, browse audio sources, add a music track to a playback queue, learn more about a music track (such as track title or track artists), or view what music track is next in the playback queue.

[0024] Listening to audio content out loud can also be an individual experience. For example, an individual may play music out loud for themselves in the morning before work, in the evening during dinner, or at other times throughout the day at home, work, or on the road. For these individual experiences, the individual may choose to either use headphones, or limit the out loud playback of audio content to a single zone or area.

[0025] Discovery of audio can also be an important element of the experience. By way of illustration, discovery may involve friends sharing their latest favorite new song, artist, or playlist with each other. In some cases, discovery may involve browsing music magazines and periodicals that regularly review the latest releases. In addition, some online music services, radio stations, and disc jockeys are also means for people to share and discover new music or audio.

[0026] Example systems, methods, apparatus, and articles of manufacture disclosed herein provide for configuration of a playback system in a restricted access mode (e.g., a party playlist mode) in which authorized or other participating users can access and interact with a certain specified set of content and system function. For example, an authorized user can view a library of available content for playback and select content to be added to the playlist (e.g., perhaps subject to approval of the host/moderator and/or a vote of other participants). Example systems and methods disclosed and described herein may be advantageously used to provide improved

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usability and configurability for varied playback of media content (e.g., audio and/or video) in a network environment.

[0027] Many other embodiments are provided and described herein.

II. An Example Operating Environment

[0028] Referring now to the drawings, in which like numerals can refer to like parts throughout the figures, Figure 1 shows an example system 100 in which one or more embodiments disclosed herein can be practiced or implemented.

[0029] By way of illustration, system 100 represents a home presently configured with multiple zones, though the home could have been configured with only one zone. Each zone in the home, for example, may represent a different room or space, such as an office, bathroom, bedroom, kitchen, dining room, family room, home theater room, utility or laundry room, and patio. A single zone might also include multiple rooms if so configured. One or more of zone players 102-124 are shown in each respective zone of the home. A zone player 102-124, also referred to as a playback device, multimedia unit, speaker, player, and so on, provides audio, video, and/or audiovisual output. Controller 130 provides control to system 100. Controller 130 may be fixed to a zone, or alternatively, mobile such that it can be moved about the zones. System 100 may also include more than one controller 130. System 100 illustrates an example whole house audio system, though it is understood that the technology described herein is not limited to its particular place of application or to an expansive system like a whole house audio system 100 of Figure 1.

a. Example zone players

[0030] Figures 2A, 2B, and 2C show example types of zone players. Zone players 200, 202, and 204 of Figures 2A, 2B, and 2C, respectively, can correspond to any of the zone players 102-124 of Figure 1, for example. In some embodiments, audio is reproduced using only a single zone player, such as by a full-range player. In some embodiments, audio is reproduced using two or more zone players, such as by using a combination of full-range players or a combination of full-range and specialized players. In some embodiments, zone players 200-204 may also be referred to as a "smart speaker," because they contain processing capabilities beyond the reproduction of audio, more of which is described below.

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[0031] Figure 2A illustrates zone player 200 that includes sound producing equipment 208 capable of reproducing full-range sound. The sound may come from an audio signal that is received and processed by zone player 200 over a wired or wireless data network. Sound producing equipment 208 includes one or more built-in amplifiers and one or more speakers. A built-in amplifier is described more below with respect to Figure 4. A speaker or acoustic transducer can include, for example, any of a tweeter, a mid-range driver, a low-range driver, and a subwoofer. In some embodiments, zone player 200 can be statically or dynamically configured to play stereophonic audio, monaural audio, or both. In some embodiments, zone player 200 is configured to reproduce a subset of full-range sound, such as when zone player 200 is grouped with other zone players to play stereophonic audio, monaural audio, and/or surround audio or when the audio content received by zone player 200 is less than full-range.

[0032] Figure 2B illustrates zone player 202 that includes a built-in amplifier to power a set of detached speakers 210. A detached speaker can include, for example, any type of loudspeaker. Zone player 202 may be configured to power one, two, or more separate loudspeakers. Zone player 202 may be configured to communicate an audio signal (e.g., right and left channel audio or more channels depending on its configuration) to the detached speakers 210 via a wired path.

[0033] Figure 2C illustrates zone player 204 that does not include a built-in amplifier, but is configured to communicate an audio signal, received over a data network, to an audio (or "audio/video") receiver 214 with built-in amplification.

[0034] Referring back to Figure 1, in some embodiments, one, some, or all of the zone players 102 to 124 can retrieve audio directly from a source. For example, a zone player may contain a playlist or queue of audio items to be played (also referred to herein as a "playback queue"). Each item in the queue may comprise a uniform resource identifier (URI) or some other identifier. The URI or identifier can point the zone player to the audio source. The source might be found on the Internet (e.g., the cloud), locally from another device over data network 128, the controller 130, stored on the zone player itself, or from an audio source communicating directly to the zone player. In some embodiments, the zone player can reproduce the audio itself, send it to another zone player for reproduction, or both where the audio is played by the zone player and one or more additional zone players in synchrony. In some embodiments, the zone player can

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play a first audio content (or not play at all), while sending a second, different audio content to another zone player(s) for reproduction.

[0035] By way of illustration, SONOS, Inc. of Santa Barbara, California presently offers for sale zone players referred to as a "PLAY:5," "PLAY:3," "CONNECT:AMP," "CONNECT," and "SUB." Any other past, present, and/or future zone players can additionally or alternatively be used to implement the zone players of example embodiments disclosed herein. Additionally, it is understood that a zone player is not limited to the particular examples illustrated in Figures 2A, 2B, and 2C or to the SONOS product offerings. For example, a zone player may include a wired or wireless headphone. In yet another example, a zone player might include a sound bar for television. In yet another example, a zone player can include or interact with a docking station for an Apple IPOD™ or similar device.

b. Example controllers

[0036] Figure 3 illustrates an example wireless controller 300 in docking station 302. By way of illustration, controller 300 can correspond to controlling device 130 of Figure 1. Docking station 302, if provided, may be used to charge a battery of controller 300. In some embodiments, controller 300 is provided with a touch screen 304 that allows a user to interact through touch with the controller 300, for example, to retrieve and navigate a playlist of audio items, control operations of one or more zone players, and provide overall control of the system configuration 100. In certain embodiments, any number of controllers can be used to control the system configuration 100. In some embodiments, there can be a limit set on the number of controllers that can control the system configuration 100. The controllers might be wireless like wireless controller 300 or wired to data network 128.

[0037] In some embodiments, if more than one controller is used in system 100, then each controller may be coordinated to display common content, and may all be dynamically updated to indicate changes made from a single controller. Coordination can occur, for instance, by a controller periodically requesting state information directly or indirectly from one or more zone players; the state information may provide information about system 100, such as current zone group configuration, what is playing in one or more zones, volume levels, and other items of interest. The state information may be passed around on data network 128 between zone players (and controllers, if so desired) as needed or as often as programmed.

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[0038] In addition, an application running on any network-enabled portable device, such as an IPHONE™, IPAD™, ANDROID™ powered phone, or any other smart phone or network-enabled device can be used as controller 130. An application running on a laptop or desktop personal computer (PC) or MAC™ can also be used as controller 130. Such controllers may connect to system 100 through an interface with data network 128, a zone player, a wireless router, or using some other configured connection path. Example controllers offered by SONOS, Inc. of Santa Barbara, California include a "Controller 200," "SONOS® CONTROL," "SONOS® Controller for IPHONE™," "SONOS® Controller for IPAD™," "SONOS® Controller for ANDROID™, "SONOS® Controller for MAC or PC."

c. Example data connection

[0039] Zone players 102 to 124 of Figure 1 are coupled directly or indirectly to a data network, such as data network 128. Controller 130 may also be coupled directly or indirectly to data network 128 or individual zone players. Data network 128 is represented by an octagon in the figure to stand out from other representative components. While data network 128 is shown in a single location, it is understood that such a network is distributed in and around system 100. Particularly, data network 128 can be a wired network, a wireless network, or a combination of both wired and wireless networks. In some embodiments, one or more of the zone players 102-124 are wirelessly coupled to data network 128 based on a proprietary mesh network. In some embodiments, one or more of the zone players 102-124 are wirelessly coupled to data network 128 using a non-mesh topology. In some embodiments, one or more of the zone players 102-124 are coupled via a wire to data network 128 using Ethernet or similar technology. In addition to the one or more zone players 102-124 connecting to data network 128, data network 128 can further allow access to a wide area network, such as the Internet.

[0040] In some embodiments, connecting any of the zone players 102-124, or some other connecting device, to a broadband router, can create data network 128. Other zone players 102-124 can then be added wired or wirelessly to the data network 128. For example, a zone player (e.g., any of zone players 102-124) can be added to the system configuration 100 by simply pressing a button on the zone player itself (or perform some other action), which enables a connection to be made to data network 128. The broadband router can be connected to an Internet Service Provider (ISP), for example. The broadband router can be used to form another

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data network within the system configuration 100, which can be used in other applications (e.g., web surfing). Data network 128 can also be used in other applications, if so programmed. An example, second network may implement SonosNet protocol, developed by SONOS, Inc. of Santa Barbara. Sonsonate represents a secure, AES-encrypted, peer-to-peer wireless mesh network. Alternatively, in certain embodiments, the data network 128 is the same network, such as a traditional wired or wireless network, used for other applications in the household.

d. Example zone configurations

[0041] A particular zone can contain one or more zone players. For example, the family room of Figure 1 contains two zone players 106 and 108, while the kitchen is shown with one zone player 102. In another example, the home theater room contains additional zone players to play audio from a 5.1 channel or greater audio source (e.g., a movie encoded with 5.1 or greater audio channels). In some embodiments, one can position a zone player in a room or space and assign the zone player to a new or existing zone via controller 130. As such, zones may be created, combined with another zone, removed, and given a specific name (e.g., "Kitchen"), if so desired and programmed to do so with controller 130. Moreover, in some embodiments, zone configurations may be dynamically changed even after being configured using controller 130 or some other mechanism.

[0042] In some embodiments, if a zone contains two or more zone players, such as the two zone players 106 and 108 in the family room, then the two zone players 106 and 108 can be configured to play the same audio source in synchrony, or the two zone players 106 and 108 can be paired, allowing the separate audio channels to be played by different players, for example. In other words, the stereo effects of a sound can be reproduced or enhanced through the two zone players 106 and 108, one for the left sound and the other for the right sound. In certain embodiments, paired zone players (also referred to as "bonded zone players") can play audio in synchrony with other zone players in the same or different zones.

[0043] In some embodiments, two or more zone players can be sonically consolidated to form a single, consolidated zone player. A consolidated zone player (though made up of multiple, separate devices) can be configured to process and reproduce sound differently than an unconsolidated zone player or zone players that are paired, because a consolidated zone player will have additional speaker drivers from which sound can be passed. The consolidated zone

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player can further be paired with a single zone player or yet another consolidated zone player. Each playback device of a consolidated playback device can be set in a consolidated mode, for example.

[0044] According to some embodiments, one can continue to do any of: group, consolidate, and pair zone players, for example, until a desired configuration is complete. The actions of grouping, consolidation, and pairing are preferably performed through a control interface, such as using controller 130, and not by physically connecting and re-connecting speaker wire, for example, to individual, discrete speakers to create different configurations. As such, certain embodiments described herein provide a more flexible and dynamic platform through which sound reproduction can be offered to the end-user.

e. Example audio sources

[0045] In some embodiments, each zone can play from the same audio source as another zone or each zone can play from a different audio source. For example, someone can be grilling on the patio and listening to jazz music via zone player 124, while someone is preparing food in the kitchen and listening to classical music via zone player 102. Further, someone can be in the office listening to the same jazz music via zone player 110 that is playing on the patio via zone player 124. In some embodiments, the jazz music played via zone players 110 and 124 is played in synchrony. Synchronizing playback amongst zones allows for someone to pass through zones while seamlessly (or substantially seamlessly) listening to the audio. Further, zones can be put into a "party mode" such that all associated zones will play audio in synchrony.

[0046] Sources of audio content to be played by zone players 102-124 are numerous. In some embodiments, music on a zone player itself may be accessed and a played. In some embodiments, music from a personal library stored on a computer or networked-attached storage (NAS) may be accessed via the data network 128 and played. In some embodiments, Internet radio stations, shows, and podcasts can be accessed via the data network 128. Music or cloud services that let a user stream and/or download music and audio content can be accessed via the data network 128. Further, music can be obtained from traditional sources, such as a turntable or CD player, via a line-in connection to a zone player, for example. Audio content can also be accessed using a different protocol, such as AIRPLAY™, which is a wireless technology by Apple, Inc., for example. Audio content received from one or more sources can be shared

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amongst the zone players 102 to 124 via data network 128 and/or controller 130. The above-disclosed sources of audio content are referred to herein as network-based audio information sources. However, network-based audio information sources are not limited thereto.

[0047] In some embodiments, the example home theater zone players 116, 118, 120 are coupled to an audio information source such as a television 132. In some examples, the television 132 is used as a source of audio for the home theater zone players 116, 118, 120, while in other examples audio information from the television 132 can be shared with any of the zone players 102-124 in the audio system 100.

III. Zone Players

[0048] Referring now to Figure 4, there is shown an example block diagram of a zone player 400 in accordance with an embodiment. Zone player 400 includes a network interface 402, a processor 408, a memory 410, an audio processing component 412, one or more modules 414, an audio amplifier 416, and a speaker unit 418 coupled to the audio amplifier 416. Figure 2A shows an example illustration of such a zone player. Other types of zone players may not include the speaker unit 418 (e.g., such as shown in Figure 2B) or the audio amplifier 416 (e.g., such as shown in Figure 2C). Further, it is contemplated that the zone player 400 can be integrated into another component. For example, the zone player 400 could be constructed as part of a television, lighting, or some other device for indoor or outdoor use.

[0049] In some embodiments, network interface 402 facilitates a data flow between zone player 400 and other devices on a data network 128. In some embodiments, in addition to getting audio from another zone player or device on data network 128, zone player 400 may access audio directly from the audio source, such as over a wide area network or on the local network. In some embodiments, the network interface 402 can further handle the address part of each packet so that it gets to the right destination or intercepts packets destined for the zone player 400. Accordingly, in certain embodiments, each of the packets includes an Internet Protocol (IP)-based source address as well as an IP-based destination address.

[0050] In some embodiments, network interface 402 can include one or both of a wireless interface 404 and a wired interface 406. The wireless interface 404, also referred to as a radio frequency (RF) interface, provides network interface functions for the zone player 400 to wirelessly communicate with other devices (e.g., other zone player(s), speaker(s), receiver(s),

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component(s) associated with the data network 128, and so on) in accordance with a communication protocol (e.g., any wireless standard including IEEE 802.11a, 802.11b, 802.11g, 802.11n, or 802.15). Wireless interface 404 may include one or more radios. To receive wireless signals and to provide the wireless signals to the wireless interface 404 and to transmit wireless signals, the zone player 400 includes one or more antennas 420. The wired interface 406 provides network interface functions for the zone player 400 to communicate over a wire with other devices in accordance with a communication protocol (e.g., IEEE 802.3). In some embodiments, a zone player includes both of the interfaces 404 and 406. In some embodiments, a zone player 400 includes only the wireless interface 404 or the wired interface 406.

[0051] In some embodiments, the processor 408 is a clock-driven electronic device that is configured to process input data according to instructions stored in memory 410. The memory 410 is data storage that can be loaded with one or more software module(s) 414, which can be executed by the processor 408 to achieve certain tasks. In the illustrated embodiment, the memory 410 is a tangible machine-readable medium storing instructions that can be executed by the processor 408. In some embodiments, a task might be for the zone player 400 to retrieve audio data from another zone player or a device on a network (e.g., using a uniform resource locator (URL) or some other identifier). In some embodiments, a task may be for the zone player 400 to send audio data to another zone player or device on a network. In some embodiments, a task may be for the zone player 400 to synchronize playback of audio with one or more additional zone players. In some embodiments, a task may be to pair the zone player 400 with one or more zone players to create a multi-channel audio environment. Additional or alternative tasks can be achieved via the one or more software module(s) 414 and the processor 408.

[0052] The audio processing component 412 can include one or more digital-to-analog converters (DAC), an audio preprocessing component, an audio enhancement component or a digital signal processor, and so on. In some embodiments, the audio processing component 412 may be part of processor 408. In some embodiments, the audio that is retrieved via the network interface 402 is processed and/or intentionally altered by the audio processing component 412. Further, the audio processing component 412 can produce analog audio signals. The processed analog audio signals are then provided to the audio amplifier 416 for play back through speakers 418. In addition, the audio processing component 412 can include circuitry to process analog or digital signals as inputs to play from zone player 400, send to another zone player on a network,

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or both play and send to another zone player on the network. An example input includes a line-in connection (e.g., an auto-detecting 3.5mm audio line-in connection).

[0053] The audio amplifier 416 is a device(s) that amplifies audio signals to a level for driving one or more speakers 418. The one or more speakers 418 can include an individual transducer (e.g., a "driver") or a complete speaker system that includes an enclosure including one or more drivers. A particular driver can be a subwoofer (e.g., for low frequencies), a mid-range driver (e.g., for middle frequencies), and a tweeter (e.g., for high frequencies), for example. An enclosure can be sealed or ported, for example. Each transducer may be driven by its own individual amplifier.

[0054] A commercial example, presently known as the PLAY:5, is a zone player with a built-in amplifier and speakers that is capable of retrieving audio directly from the source, such as on the Internet or on the local network, for example. In particular, the PLAY:5 is a five-amp, five-driver speaker system that includes two tweeters, two mid-range drivers, and one woofer. When playing audio content via the PLAY:5, the left audio data of a track is sent out of the left tweeter and left mid-range driver, the right audio data of a track is sent out of the right tweeter and the right mid-range driver, and mono bass is sent out of the subwoofer. Further, both mid-range drivers and both tweeters have the same equalization (or substantially the same equalization). That is, they are both sent the same frequencies, but from different channels of audio. Audio from Internet radio stations, online music and video services, downloaded music, analog audio inputs, television, DVD, and so on, can be played from the PLAY:5.

IV. Controller

[0055] Referring now to Figure 5, there is shown an example block diagram for controller 500, which can correspond to the controlling device 130 in Figure 1. Controller 500 can be used to facilitate the control of multi-media applications, automation and others in a system. In particular, the controller 500 may be configured to facilitate a selection of a plurality of audio sources available on the network and enable control of one or more zone players (e.g., the zone players 102-124 in Figure 1) through a wireless or wired network interface 508. According to one embodiment, the wireless communications is based on an industry standard (e.g., infrared, radio, wireless standard including IEEE 802.11a, 802.11b 802.11g, 802.11n, or 802.15, and so on). Further, when a particular audio is being accessed via the controller 500 or being played via

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a zone player, a picture (e.g., album art) or any other data, associated with the audio and/or audio source can be transmitted from a zone player or other electronic device to controller 500 for display.

[0056] Controller 500 is provided with a screen 502 and an input interface 514 that allows a user to interact with the controller 500, for example, to navigate a playlist of many multimedia items and to control operations of one or more zone players. The screen 502 on the controller 500 can be an LCD screen, for example. The screen 500 communicates with and is commanded by a screen driver 504 that is controlled by a microcontroller (e.g., a processor) 506. The memory 510 can be loaded with one or more application modules 512 that can be executed by the microcontroller 506 with or without a user input via the user interface 514 to achieve certain tasks. In some embodiments, an application module 512 is configured to facilitate grouping a number of selected zone players into a zone group and synchronizing the zone players for audio play back. In some embodiments, an application module 512 is configured to control the audio sounds (e.g., volume) of the zone players in a zone group. In operation, when the microcontroller 506 executes one or more of the application modules 512, the screen driver 504 generates control signals to drive the screen 502 to display an application specific user interface accordingly.

[0057] The controller 500 includes a network interface 508 that facilitates wired or wireless communication with a zone player. In some embodiments, the commands such as volume control and audio playback synchronization are sent via the network interface 508. In some embodiments, a saved zone group configuration is transmitted between a zone player and a controller via the network interface 508. The controller 500 can control one or more zone players, such as 102-124 of Figure 1. There can be more than one controller for a particular system, and each controller may share common information with another controller, or retrieve the common information from a zone player, if such a zone player stores configuration data (e.g., such as state information). Further, a controller can be integrated into a zone player.

[0058] It should be noted that other network-enabled devices such as an IPHONE®, IPAD® or any other smart phone or network-enabled device (e.g., a networked computer such as a PC or MAC®) can also be used as a controller to interact or control zone players in a particular environment. In some embodiments, a software application or upgrade can be downloaded onto a network-enabled device to perform the functions described herein.

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[0059] In certain embodiments, a user can create a group or collection of zones referred to as a bonded zone including at least two zone players from the controller 500. The zone players in the bonded zone can play audio in a synchronized fashion, such that all of the zone players in the group play back an identical audio source or a list of identical audio sources in a synchronized manner such that no (or substantially no) audible delays or hiccups are to be heard. Similarly, in some embodiments, when a user increases the audio volume of the group from the controller 500, the signals or data of increasing the audio volume for the group are sent to one of the zone players and causes other zone players in the group to be increased together in volume.

[0060] A user via the controller 500 can group zone players into a zone group by activating a "Link Zones" or "Add Zone" soft button, or de-grouping a zone group by activating an "Unlink Zones" or "Drop Zone" button. For example, one mechanism for 'joining' zone players together for audio play back is to link a number of zone players together to form a group. To link a number of zone players together, a user can manually link each zone player or room one after the other. For example, assume that there is a multi-zone system that includes the following zones: Bathroom, Bedroom, Den, Dining Room, Family Room, and Foyer.

[0061] In certain embodiments, a user can link any number of the zone players (e.g., six zone players available in the example above), for example, by starting with a single zone and then manually linking each zone to that zone.

[0062] In certain embodiments, a set of zones can be dynamically linked together using a command to create a zone scene or theme (subsequent to first creating the zone scene). For instance, a "Morning" zone scene command can link the Bedroom, Office, and Kitchen zones together in one action. Without this single command, the user would manually and individually link each zone. The single command may include a mouse click, a double mouse click, a button press, a gesture, or some other programmed action. Other kinds of zone scenes can be programmed.

[0063] In certain embodiments, a zone scene can be triggered based on time (e.g., an alarm clock function). For instance, a zone scene can be set to apply at 8:00 am. The system can link appropriate zones automatically, set specific music to play, and then stop the music after a defined duration. Although any particular zone can be triggered to an "On" or "Off" state based on time, for example, a zone scene enables any zone(s) linked to the scene to play a predefined

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audio (e.g., a favorable song, a predefined playlist) at a specific time and/or for a specific duration. If, for any reason, the scheduled music failed to be played (e.g., an empty playlist, no connection to a share, failed Universal Plug and Play (UPnP), no Internet connection for an Internet Radio station, and so on), a backup buzzer can be programmed to sound. The buzzer can include a sound file that is stored in a zone player, for example.

V. Example Configuration Systems and Methods

[0064] In an example system such as the ones shown in Figures 1 and 6, where multiple users can listen to the same audio content through one or more zone players such as those shown in Figures 2 and 4, the ability to provide crowd-sourced playlists and/or facilitate guest access to music services may be valuable.

[0065] An example system is shown in Figure 6, whereby a zone group 600 includes two zones, a Dining Room zone 610 and a Living Room zone 620, in which multiple users, via multiple controllers 630-633, can control the audio that is played in the zone group 600 via a plurality of playback devices 640-642 (e.g., a plurality of zone players and/or other media playback devices such as shown and described in Figures 1-4). As shown in the example of Figure 6, a media playback system can be configured to accept control and/or other input from multiple controllers 630-633, such as a controller 500, a smartphone, a tablet computer, a laptop computer, and/or other controlling device. Control, however, may be limited or otherwise restricted according to system permissions, preferences, etc., set by default, by owner, and so on.

[0066] In certain embodiments, a party playlist mode enables users with a phone or other controller (e.g., other device running a controller software application, etc.) that has access to the playback network to control music playback. In some embodiments, playback control includes adding content to a playback system, such as adding content to a playback queue (e.g., party playlist). In other embodiments, playback control includes moderation of content playback, such as moderating the content added to the party playlist. In some embodiments, the party playlist mode can facilitate moderation of content playback to users with a phone or other controller that has access to the playback network. In some embodiments, moderation of content playback can start with a single moderator and evolve to multiple moderators as time evolves (e.g., as the party goes on), for example. In one example embodiment, people with access to the playback network can be notified when new tracks are added and be asked to vote regarding addition of the track to

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the playlist. In another example embodiment, the order or timing of the newly added track in the playlist can be voted on as well by people with access to the playback network.

[0067] In certain embodiments, playlist contributors are identified with the tracks they add and the identification of the contributors is shared with everyone to view. In this way, for example, listeners can know who added which song or track to the party playlist. In one example embodiment, the playlist contributor is not identified until their contribution has been accepted into the party playlist.

[0068] Certain embodiments provide guest access to allow participants in the playback system to bring their own content to the system on a temporary basis. For example, people can provide access to their music service accounts, the content on their mobile phones, their content stored in the cloud, and so on, for a temporary basis.

[0069] In certain embodiments, duplicate tracks or songs being added to the party playlist can be identified and rejected. For example, multiple users may simultaneously (or substantially simultaneously) add the same song or track to the playlist. To avoid multiple occurrences of the same song or track, the system can automatically reject duplicates.

[0070] Certain embodiments provide limited user access to control music playback in a shared environment. In some embodiments limited user access may apply restrictions on an entire media playback system, a single listening zone, and/or a listening zone group. In some example embodiments, limited user access may include restricting playback in certain specified listening zones and/or zone groups. In another example embodiment, limited user access may include restricting playback for a fixed time interval, during a particular time-of-day, and/or on a recurring basis.

[0071] In an example embodiment, limited user access includes a party playlist that gives limited access to play control of a particular listening zone and/or group of zones. For example, the party playlist may limit users to only adding songs or tracks to the playlist, whereas other functionality in the listening zone or zone group may be disabled. In another example, the party playlist may allow users to collectively decide (e.g., vote) if a new song or track should be added to the playlist, for example. In another example, the party playlist may also limit system configuration functionality, such as the zone grouping configuration, the music equalization

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parameters, etc. In some example embodiments, the party playlist may only be in effect for a fixed time duration, and not require explicit disabling operation.

[0072] In an example embodiment, limited user access may be applied based on authentication of the user. For example, limited user access may be applied based on authentication of a controlling device which may include registration of the controlling device and its associated identifier. In another example, authentication may include all controller devices used in the media playback system over a defined time interval (e.g., a previous twenty-four (24) hours).

[0073] Certain embodiments provide shared music access for a limited time duration in a group listening environment. Shared music may be a library of tracks or a playlist on a physical device that is accessed wirelessly by the media playback system, for example. Shared music may be a subscription service accessed independently over the Internet and/or other network, for example (e.g., a cloud-based storage, music streaming service, etc.). Subscription service credentials may be passed directly to a playback system device, for example. Subscription service may be username/password or token, for example.

[0074] While illustrative examples provided below reference music or audio as content provided, video, images and/or other multimedia content may be provided in addition or instead.

[0075] Crowd-Sourced Playlist

[0076] In some embodiments, one or more users can create a multimedia playlist. For example, a 'party playlist' mode is provided to allow multiple users to add tracks to a queue for playback via a media playback system.

[0077] A media playback system can be put into party playlist mode by an authenticated user. In an example, the user is to "sign in" such as by entering a username, a password, or a username/password combination to be authenticated. In another example, the user may be authenticated by identifying a device used to control the system (e.g., the device may be identified by a unique identifier (ID) such as a Media Access Control (MAC) address that has been registered in the playback system). For example, a SONOS™ controller may be considered such a device, or a device with a SONOS™ controller application may be registered as such a device. In another example, "Jonathan's IPHONE™" may be considered such a device if the target playback system is Jonathan's SONOS™ system. In yet another example, devices that

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have been used with respect to the media playback system within a certain time period (e.g., in a twenty-four (24)-hour period) may be considered registered. Alternatively, the playback system may be put into party playlist mode by anyone with access to the playback system.

[0078] The party playlist mode may be set to last for a fixed duration of time (e.g., four (4) hours), for example. The party playlist mode may be set to end at a specific time of day (e.g., 1 am), for example. The party playlist mode may last indefinitely until a user manually exits the mode, for example. In an embodiment, a password is generated when the playback system is put in party playlist mode and is used to exit party playlist mode. In another embodiment, no authentication is required to take the system out of party playlist mode.

[0079] Party playlist mode may apply to a single zone or zone grouping, multiple zones or zone groupings, or the entire media playback system, for example.

[0080] Once the system is put into party playlist mode, in some embodiments, users can only add music to the listening queue. Deleting tracks, changing the play mode (e.g., shuffle, repeat, etc.), or changing the system settings (e.g., zone group configuration, music equalization parameters, etc.) is not allowed. In some embodiments, some or all of the following rules or limitations are applied: an ability to modify content may be limited, an ability to affect order may be limited, an ability to adjust system configuration may be limited, and so on. For example, rules and/or other access permissions may limit whether anyone can add songs to the party playlist, no one can remove songs from the party playlist, only one song may be added at a time (rather than adding an entire album or set of content in a single action), etc. Artist repetition may be avoided by limiting a number of songs in the queue by the same artist, for example. Songs in the queue may be played randomly and/or in a predefined order, for example. In certain examples, once a song is played, the song is removed from the queue. In certain examples, no user can switch sources or change a zone grouping in party playlist mode. In other examples, certain users may be able to switch sources or change a zone grouping in party playlist mode.

[0081] A visual history of recently played tracks can be accessed and shown to users via a control device, for example. In certain embodiments, a graphical "Jukebox" screen can be shown on the control device.

[0082] In an embodiment, a method is used to determine if a new track should be added to the playlist. In an embodiment, all tracks are added to the playlist in an unrestricted fashion. In

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another embodiment, the playlist is moderated by an "owner" of the media playback system. In another embodiment, the playlist is moderated by the crowd or collection of users. For example, when a user attempts to add a track to the playlist, notification is sent to users in the crowd. Notification can be in the form of an application-based notification (e.g., a notification message within a Sonos application), a text message, an instant message, or some other messaging scheme. Any number of users can be selected to participate in the moderation, and the user selection may be at random when a subset of the crowd is selected. Once notification is sent to the users to vote, they are given a fixed time duration (e.g., two (2) minutes) to vote on adding the track to the listening queue. The system can use a majority-rule to determine if the track is added or not. In certain embodiments, certain role(s) (e.g., a disc jockey (DJ), host, organizer, etc.) may have discretion or take priority to add or approve addition of a track to the party playlist, for example.

[0083] In an example in which duplicate songs are not allowed, multiple users may try to add the same track or song to the queue. In an embodiment, duplicate tracks are identified by comparing the source location and track identifiers. In another embodiment, duplicate tracks are identified by comparing the metadata (e.g., artist, track name, length of track, etc.) between the tracks. In yet another embodiment, duplicate tracks are identified by comparing the musical composition of both tracks. The comparison may be done directly in the system or via a service hosted locally or in the Internet "cloud", for example.

[0084] In an embodiment, the user or users that add a track to the queue are identified for others to see. In an embodiment, the user or users that add the track are identified in the queue alongside the track name. In another embodiment, the user or users that add the track are identified by drilling down (e.g., double-click, touch, hover over, etc.) on the track name.

[0085] In an embodiment, authentication mechanisms as described above may be used to identify the user or users that added the track. In another embodiment, the user may be asked to enter a name along with the track to be added.

[0086] In an embodiment, the user who added the track to the playlist is notified if the track has been successfully added or rejected from the listening queue.

[0087] Guest Access

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[0088] In an example media playback system, music that is added to the party playlist can come from many different sources. In an embodiment, music can be selected from sources already associated with the playback system. Already-associated sources may include an indexed music library that is on a Local Area Network (e.g., music stored on a PC or MAC™ computer, a network attached storage device, a docked IPOD™ or IPHONE™, or another wired or wireless device that has been indexed as part of the playback system), an indexed music library that is stored in the "cloud" over the Internet (e.g., a cloud-based music storage such as Apple ICLOUD™ or Amazon Cloud Player, etc.), or an Internet music service that provides streaming content over the Internet (e.g., PANDORA™, RHAPSODY™, SPOTIFY™, etc.) . In another embodiment, the music can be played to the media playback system (e.g., a SONOS™ system) from a third party software application such as SPOTIFY™ or FACEBOOK™. In another embodiment, the music can be played directly from the device on which the content resides (e.g., music stored on an IPHONE™, IPAD™, IPOD™, or ANDROID™ device).

[0089] In another embodiment, a 'guest pass' mode allows users to share their music services with other users in the crowd on a temporary basis. For example, users may want to share their SPOTIFY™ account temporarily if the playback system does not have a SPOTIFY™ account already associated with the system. In another example, users wanting to share a personal playlist may want to share their SPOTIFY™ account temporarily even if the system already has a SPOTIFY™ account associated with it. In an embodiment, guest access requires the guest to be linked to the playback system. In an embodiment, the guest is linked to the playback system using a configuration sequence including a special button press on a system device. When the guest is linked to the playback system as a guest, user credentials (e.g., username/password, token, etc.) are transferred to the playback system from the user in a secure fashion. The user credentials are used to register the playback system with a music service, for example. In an embodiment, the user credentials are passed directly to a media playback system device using wired or wireless communication. In another embodiment, the user credentials are transmitted to a media playback system device from a mobile device by first connecting through the mobile network (e.g., a 3G or 4G network) and then connecting to the playback system through an Internet or other network connection. Guest access may be set to last for a fixed duration of time (e.g., four (4) hours). Guest access may be set to end at a specific time of day (e.g., 1 am). Guest access may last as long as the user is connected to the network, or it may last indefinitely until a

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user manually exits the mode. In an embodiment, when guest access is terminated, the user credentials are purged from the system.

[0090] In certain embodiments, guest credentials (e.g., password) shall not be retrievable from the system. An owner of the account, however, may allow a 'user id' to be displayed by the system on controllers in certain circumstances (e.g., associated with a song playing from their account, similar to above user attribution). In an example, guest access may be terminated via a refutation mechanism that does not require the guest still be attached to the hosting system or on the local network. This could be via an Internet online multimedia authorization protocol (OMAP) or similar protocol using an Internet connection (including a mobile connection), for example.

[0091] Restricted Mode

[0092] In some embodiments, the example media playback system includes one or more restrictions that limit access to control music playback. Certain embodiments include a 'restricted' mode that limits users to certain functionality. In the example playback system described and disclosed above, the party playlist mode may limit user access to adding tracks to a listening queue, for example. In another example system, users are limited as to a time of day at which they can control the playback of music. In another example system, users are limited as to the zones or zone groups that they can control. For example, in a household with young children, parents may wish to limit their children to playback control only in the living room and the children's bedroom(s). In another example, parents may want to limit their children to playback control only during the hours of 9am to 7pm. In another example, parents may want to do both: limit their children to playback control only during the hours of 9am to 7pm and also only in the living room and child bedroom(s). In another example system, users are limited to the type of content that they can play. In some embodiments, the content is limited by the playback system using an "explicit" tag embedded in a digital music file. In another embodiment, the content is limited by the system to the location of the source or the streaming service.

[0093] In certain embodiments, a user may be limited in a number of tracks that the user can add to the queue. For example, the host can allot or credit the user with a number of tracks to be added, such as by selecting the user's controller from a list of linked controllers, by providing the user with a token or activation code, and so on. Each song added by the user to the party playlist

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is deducted from the user's allotment or credit, for example. In an embodiment, the host is a business establishment, and the user is a customer of that establishment. The customer can influence the playlist at the establishment as they would with a traditional jukebox, for example.

[0094] Example Party Playlist Methods

[0095] Figure 7 illustrates a flow diagram of an example method 700 to implement a party playlist mode in a media playback system. At block 710, a playback or "Now Playing" screen is displayed. For example, a listing of a playlist and currently playing song can be displayed via a controller, such as controller 500 (e.g., a controller application running on an IPHONE™, ANDROID™, or IPAD™).

[0096] At block 720, a party playlist mode is selected. The mode may be manually selected by a user or selected according to a schedule and/or other automated trigger. For example, the user may select an option via a controller to trigger entry into the party playlist mode. In another example, a user may schedule the party playlist mode to begin at a certain time on a certain day for a party. At block 730, a user is authenticated to determine authorization of that user to enter the party playlist mode. For example, the user is authenticated based on a username and password, token, password alone, biometric identification, and so on. In another example, the user is authenticated based on the identification of the controller that is being used.

[0097] At block 740, the media playback system enters party playlist mode. In party playlist mode, user(s) (e.g., all users within range (e.g., at a party), authorized users, etc.) can add content to the party playlist for playback via a local playback system (e.g., a household SONOS™ system local to the party). In certain embodiments, in party playlist mode, user(s) can specify priority/order of content. In certain embodiments, in party playlist mode, user(s) can specify a zone (re)configuration, for example. In certain embodiments, in party playlist mode, user(s) can specify volume and/or other parameters (e.g., in general and/or associated with their particular added track(s)). In certain embodiments, changes made by a user may be subject to approval and/or override (e.g., by a host/owner/administrator, by a vote of participants, etc.).

[0098] In certain embodiments, a remote user can add content to the playlist queue. For example, a party host can give a remote user access to modify the party playlist (e.g., the host can message her old college roommate to ask about the song they loved to dance to in college and ask her old roommate to remotely add the song from her collection to the host's playlist,

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etc.). Remote adding of content to the party playlist can be facilitated by providing a content identifier (e.g., a song name), a copy of the content, etc.

[0099] At block 750, an exit from party playlist mode is selected. The mode may be may be manually selected by a user or selected according to a schedule and/or other automated trigger. For example, the user may select an option via a controller to trigger exit from the party playlist mode. In another example, a user may schedule the party playlist mode to end at a certain time on a certain day. At block 760, a user is authenticated to determine authorization of that user to exit the party playlist mode. For example, the user is authenticated based on a username and password, token, password alone, biometric identification, and so on. In another example, the user is authenticated based on the identification of the controller that is being used. Once the playback system has exited the party playlist mode, normal operation of the playback system can resume.

[00100] Figure 8 illustrates a flow diagram of an example method 800 to facilitate addition of content to a party playlist. At block 810, the local playback system waits for a user to add content to the party playlist. For example, a guest at a party may be given access to modify the playlist or queue of content for playback via the host's local playback system (e.g., household playback system, nightclub playback system, business playback system, etc.). Guest user access can be validated and/or otherwise authenticated to determine authorization to access the party playlist, for example.

[00101] At block 820, content is added by the user to the party playlist. For example, the user utilizes a controller, such as controller 500 (e.g., a controller application running on a smartphone or tablet computer), to browse/search, select, and add content to the party playlist. In certain embodiments, the user is given access (perhaps limited) to the host's content for addition to the playlist. In certain embodiments, the user is able to access his or her own content for referral and/or addition to the playlist. In certain embodiments, the user is able to access one or more streaming and/or cloud-based content services to route content to the party playlist.

[00102] At block 830, participating users are identified. For example, if a plurality of people attending a party has access to the party playlist via one or more controllers, the plurality of people are identified as participating users. Participating users may be identified based on

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controller, user authentication, user registration, activity with respect to the playlist or other part of the local playback system, etc.

[00103] At block 840, based on criteria the host provides (e.g., a number of participating (e.g., controlling) users are present above a threshold), then a message is sent to the users to vote. For example, the host can set a threshold above which users can vote on addition and/or other adjustment of content to the party playlist. The number of participating users can be set by default, for example. The number of users may be more than one, for example.

[00104] At block 850, the voting users determine if the content is added to the party playlist. For example, each eligible voting user receives a message and request to vote via a controller (e.g., a smartphone or tablet controller application, etc.) associated with that user. In certain embodiments, a voting scheme can be configured, such as a simple majority and/or other voting scheme. In certain embodiments, a moderator, such as a host or disc jockey, can override a user vote.

[00105] At block 860, if user voting is not employed, if too few votes are cast, or if the host elects for other reason(s), a moderator (e.g., the host) decides whether the content is to be added to the party playlist. For example, if only one participating user is present and/or the minimum number set in the system is not satisfied, then the moderator/host arbitrates the addition of content to the party playlist. As another example, the moderator/host may override or veto the vote of participating users.

[00106] At block 870, the requesting user is notified of the decision regarding the content to be added. Such notification may include comments and/or additional information including, for example, the vote tally, moderator comments, etc. For example, a user attempting to add a song to the party playlist is sent a message notifying him/her regarding whether the song was successfully added or rejected with respect to the party playlist.

[00107] The playback system then resumes waiting, in party playlist mode, for a user to request content to be added to the party playlist. Although the example of Figure 8 has been described with respect to content (e.g., audio, video, and/or other media content), it is understood that the example method 800 can be executed with respect to zone group configuration, volume and/or other parameter settings, and so on for the local playback system in party mode.

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[00108] Figures 9-15 illustrate an example sequence of user interfaces facilitating content selection, playback and configuration in a party playlist mode. As shown in the example of Figure 9, a user interface 900 includes a list or other set of audio tracks available to be selected for a playlist in a party playlist mode, for example. In Figure 9, a playback queue can be found at 902. In this example, the playback queue 902 corresponds to the "Office" zone 906. Also in Figure 9, a play indicator 904 appears to the left of the item currently playing in the playback queue (e.g., currently a pause symbol is shown that indicates the user can pause the play by selecting the symbol). When the current item ends, the next item in the queue starts to play, and play continues through the list until the queue is completed or some other action like "repeat" is selected.

[00109] In Figure 10, a user is asked to create a password 1010 when starting a party playlist mode. For example, a host may be asked to establish a password 1010 and/or other identifier that a participating user is to provide in order to add content to the playlist. In certain embodiments, a password and/or other authorization may be required to enter and/or to exit party playlist mode. In certain embodiments, a host may have a moderator password separate from a participating user password, where each password provides a differing level of access to affect content and/or behavior of the media playback system, for example. As shown in the example of Figure 11, in order to exit party playlist mode, the user (e.g., the host) is to enter a password 1100 and/or other identification via the interface.

[00110] Figure 12 shows an example of a restricted set of functions 1210 made available to a participating user in party playlist mode. In the example of Figure 12, a user is provided with options 1210 to add selected content (e.g., track, album, etc.) to a playback queue or retrieve information regarding selected content (e.g., retrieve artist, album, date, etc., for a selected song). Figure 13 shows another example of commands 1310 made available to a participating user who is requesting that content be added to a party playlist. Rather than playing or adding radio stations, in the example of Figure 13, a user is only able to add more music, delete a track he/she added from the playlist, rename, etc. As shown in the example of Figure 14, a party playlist queue can be displayed to a participating user, along with an indication 1410 that the selected zone group is in party playlist or "Jukebox" mode. In the example of Figure 14, a user can add single songs that are to be played randomly from the party playlist. In Figure 15, once party

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playlist mode has been exited, the example interface provides a notification 1510 that the party playlist mode is now off.

VI. Conclusion

[00111] As discussed above, systems and methods are provided to offer a restricted playback mode (e.g., a party playlist mode) to allow one or more participating users to access a media playback system and interact with a reduced subset of functions in that system (e.g., add content to a party playlist, vote on content, etc.). The embodiments described herein may be further useful by systems in which a limited-time, group-based access to a subset of available functionality is required or preferred.

[00112] Thus certain embodiments provide a method including providing, via a local media playback system, a restricted playback mode open to a plurality of participating users, the restricted playback mode providing a subset of playback functions from the local media playback system to the participating users, the subset including addition of content to a playlist for playback via the local media playback system. The example method includes facilitating addition of content to the playlist by at least one participating user. The example method includes facilitating playback of content from the playlist in the restricted playback mode.

[00113] Certain embodiments provide a tangible computer readable storage medium including instructions which, when executed by a processor, are to implement at least a method. The example method includes providing, via a local media playback system, a restricted playback mode open to a plurality of participating users, the restricted playback mode providing a subset of playback functions from the local media playback system to the participating users, the subset including addition of content to a playlist for playback via the local media playback system. The example method includes facilitating addition of content to the playlist by at least one participating user. The example method includes facilitating playback of content from the playlist in the restricted playback mode.

[00114] Certain embodiments provide a media playback system including one or more playback devices, each playback device including a processor, a memory and a speaker to output audio content provided to the playback device. The example system includes one or more controllers, each controller to facilitate review and addition of audio content for playback via the one or more playback devices. In the example system, at least one controller is to configure the media

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playback system in a restricted playback mode open to a plurality of participating users, the restricted playback mode to provide a subset of playback functions from the media playback system to the participating users, the subset including addition of content to a playlist for playback via the media playback system, the controller to facilitate addition of content to the playlist by at least one participating user and facilitate playback of content from the playlist in the restricted playback mode.

[00115] The description discloses various example systems, methods, apparatus, and articles of manufacture including, among other components, firmware and/or software executed on hardware. However, such examples are merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of these firmware, hardware, and/or software components can be embodied exclusively in hardware, exclusively in software, exclusively in firmware, or in any combination of hardware, software, and/or firmware. Accordingly, while the following describes example systems, methods, apparatus, and/or articles of manufacture, the examples provided are not the only way(s) to implement such systems, methods, apparatus, and/or articles of manufacture.

[00116] Additionally, reference herein to "embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one example embodiment of the invention. The appearances of this phrase in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. As such, the embodiments described herein, explicitly and implicitly understood by one skilled in the art, can be combined with other embodiments.

[00117] The specification is presented largely in terms of illustrative environments, systems, procedures, steps, logic blocks, processing, and other symbolic representations that directly or indirectly resemble the operations of data processing devices coupled to networks. These process descriptions and representations are typically used by those skilled in the art to most effectively convey the substance of their work to others skilled in the art. Numerous specific details are set forth to provide a thorough understanding of the present disclosure. However, it is understood to those skilled in the art that certain embodiments of the present disclosure can be practiced without certain, specific details. In other instances, well known methods, procedures,

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components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the embodiments. Accordingly, the scope of the present disclosure is defined by the appended claims rather than the forgoing description of embodiments.

[00118] When any of the appended claims are read to cover a purely software and/or firmware implementation, at least one of the elements in at least one example is hereby expressly defined to include a tangible medium such as a memory, DVD, CD, Blu-ray, and so on, storing the software and/or firmware.

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Claims

We claim:

1. A method, comprising:

providing, via a local media playback system, a restricted playback mode open to a plurality of participating users, the restricted playback mode providing a subset of playback functions from the local media playback system to the participating users, the subset including addition of content to a playlist for playback via the local media playback system;

facilitating addition of content to the playlist by at least one participating user; and

facilitating playback of content from the playlist in the restricted playback mode.

2. The method of claim 1, wherein playback of content from the playlist in the restricted playback mode comprises random play of content from the playlist.

3. The method of claim 1, further comprising authenticating the at least one participating user to enable the at least one participating user to add content to the playlist in the restricted playback mode.

4. The method of claim 1, further comprising accepting a vote of the participating users to determine whether content is to be added to the playlist.

5. The method of claim 1, wherein facilitating addition of content further comprises accepting user selection of the content from a list of available content via a graphical user interface.

6. The method of claim 5, wherein the list of available content includes a library of shared music available via a network.

7. The method of claim 1, wherein the restricted playback mode is initiated and ended by a host user according to user authorization.

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8. The method of claim 1, further comprising configuring the restricted playback mode for a fixed time interval.

9. The method of claim 1, wherein the restricted playback mode includes a specified configuration of zones.

10. The method of claim 1, wherein the subset of playback functions further includes limited user interaction with at least one of zone configuration and content playback parameters.

11. A tangible computer readable storage medium including instructions which, when executed by a processor, are to implement at least a method, the method comprising:

providing, via a local media playback system, a restricted playback mode open to a plurality of participating users, the restricted playback mode providing a subset of playback functions from the local media playback system to the participating users, the subset including addition of content to a playlist for playback via the local media playback system;

facilitating addition of content to the playlist by at least one participating user; and

facilitating playback of content from the playlist in the restricted playback mode.

12. The computer readable storage medium of claim 11, wherein playback of content from the playlist in the restricted playback mode comprises random play of content from the playlist.

13. The computer readable storage medium of claim 11, wherein the method further comprises authenticating the at least one participating user to enable the at least one participating user to add content to the playlist in the restricted playback mode.

14. The computer readable storage medium of claim 11, wherein the method further comprises accepting a vote of the participating users to determine whether content is to be added to the playlist.

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15. The computer readable storage medium of claim 11, wherein facilitating addition of content further comprises accepting user selection of the content from a list of available content via a graphical user interface.

16. The computer readable storage medium of claim 15, wherein the list of available content includes a library of shared music available via a network.

17. The computer readable storage medium of claim 11, wherein the restricted playback mode is initiated and ended by a host user according to user authorization.

18. The computer readable storage medium of claim 11, wherein the method further comprises configuring the restricted playback mode for a fixed time interval.

19. The computer readable storage medium of claim 11, wherein the restricted playback mode includes a specified configuration of zones.

20. The computer readable storage medium of claim 11, wherein the subset of playback functions further includes limited user interaction with at least one of zone configuration and content playback parameters.

21. A media playback system comprising:

one or more playback devices, each playback device including a processor, a memory and a speaker to output audio content provided to the playback device;

one or more controllers, each controller to facilitate review and addition of audio content for playback via the one or more playback devices,

wherein at least one controller is to configure the media playback system in a restricted playback mode open to a plurality of participating users, the restricted playback mode to provide a subset of playback functions from the media playback system to the participating users, the subset including addition of content to a playlist for playback via the media playback system, the controller to facilitate addition of content to the playlist by at least one participating user and facilitate playback of content from the playlist in the restricted playback mode.

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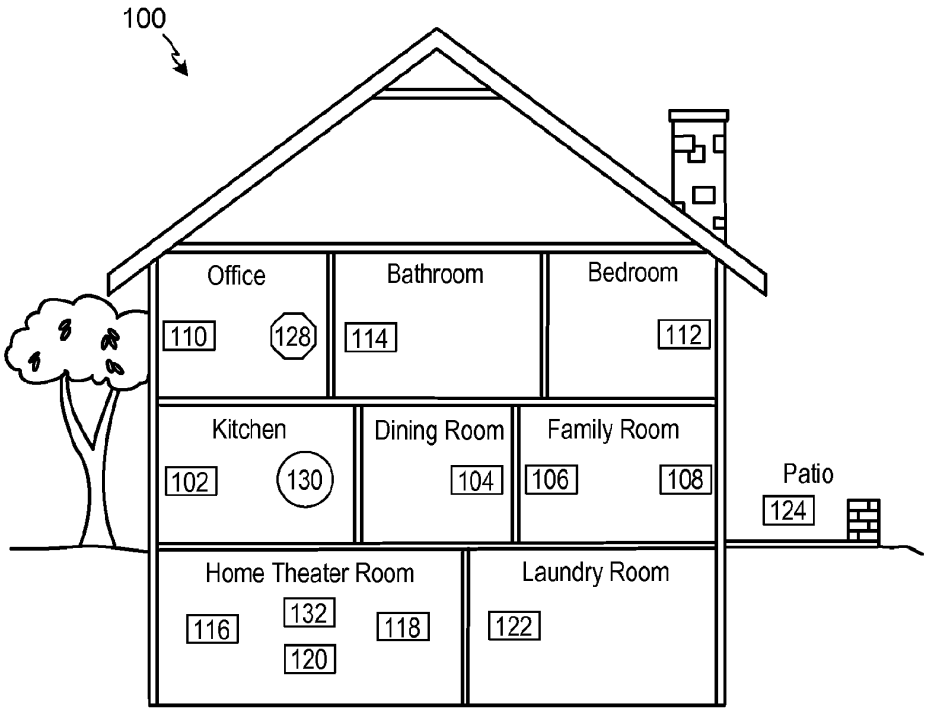


FIGURE 1

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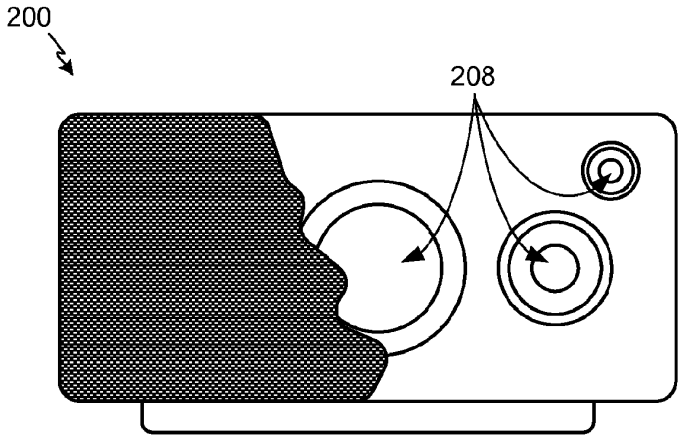


FIGURE 2A

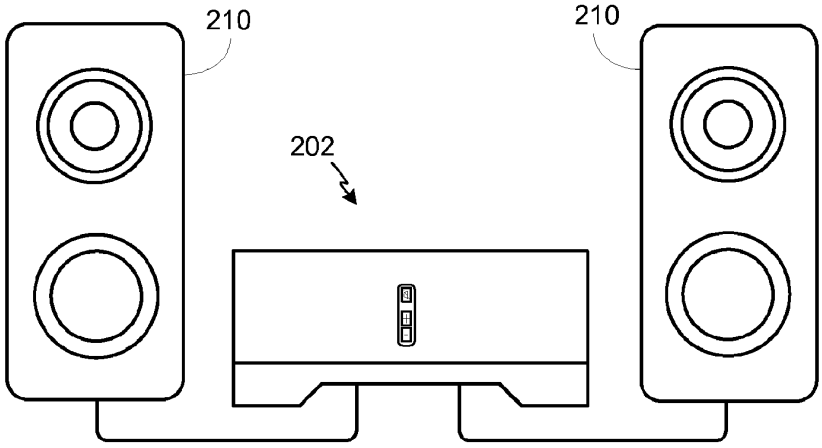


FIGURE 2B

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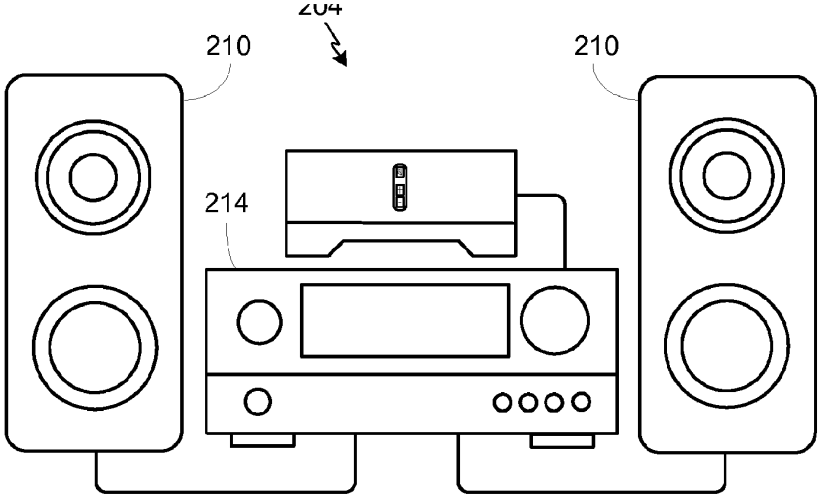


FIGURE 2C

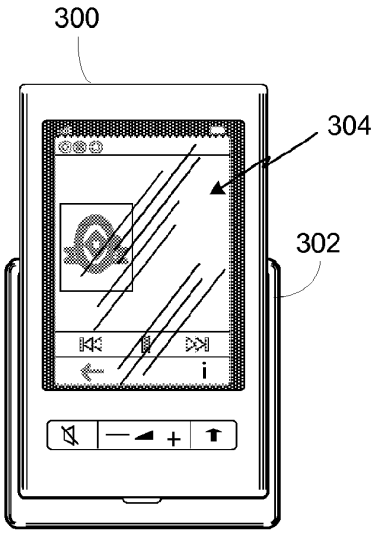


FIGURE 3

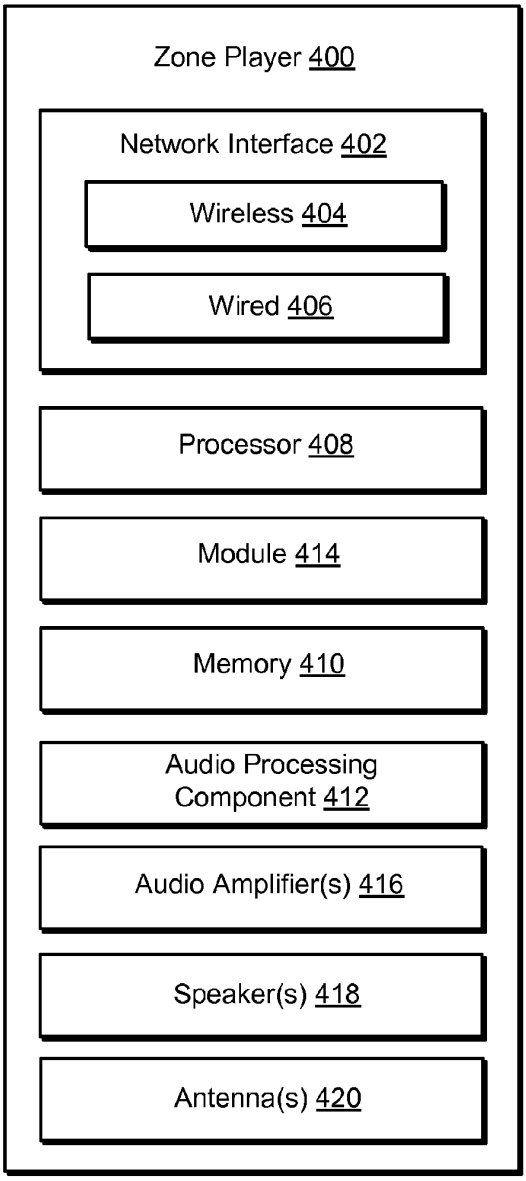


FIGURE 4

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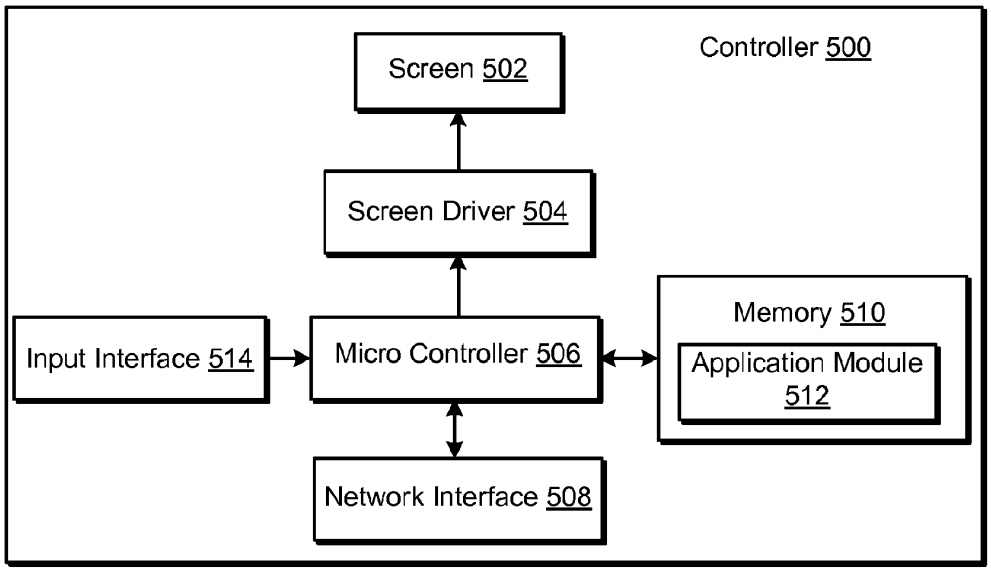


FIGURE 5

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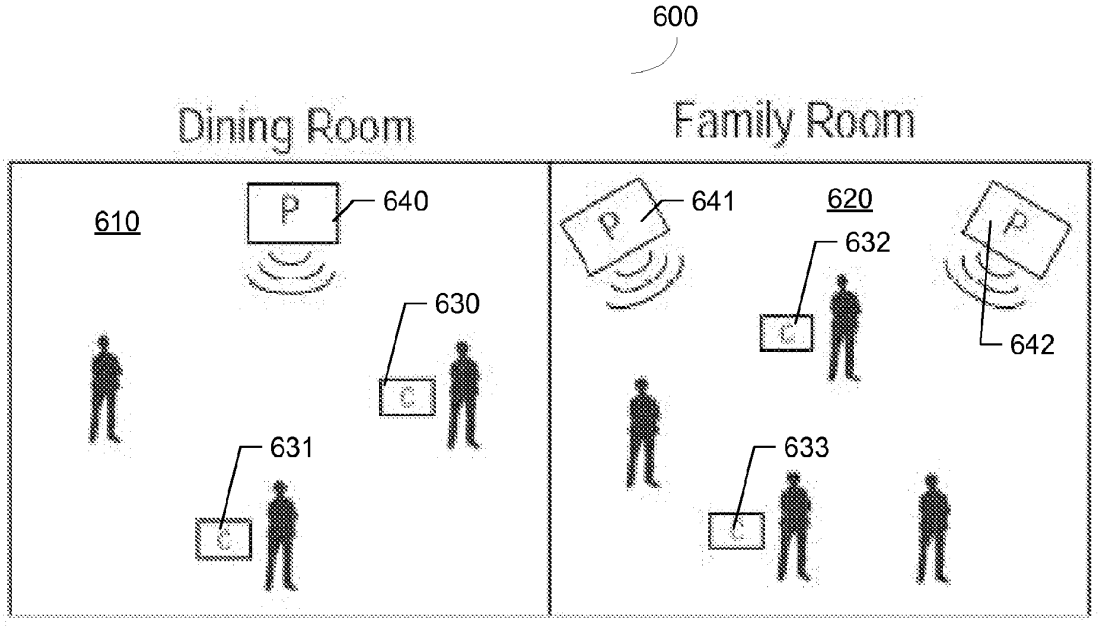


FIGURE 6

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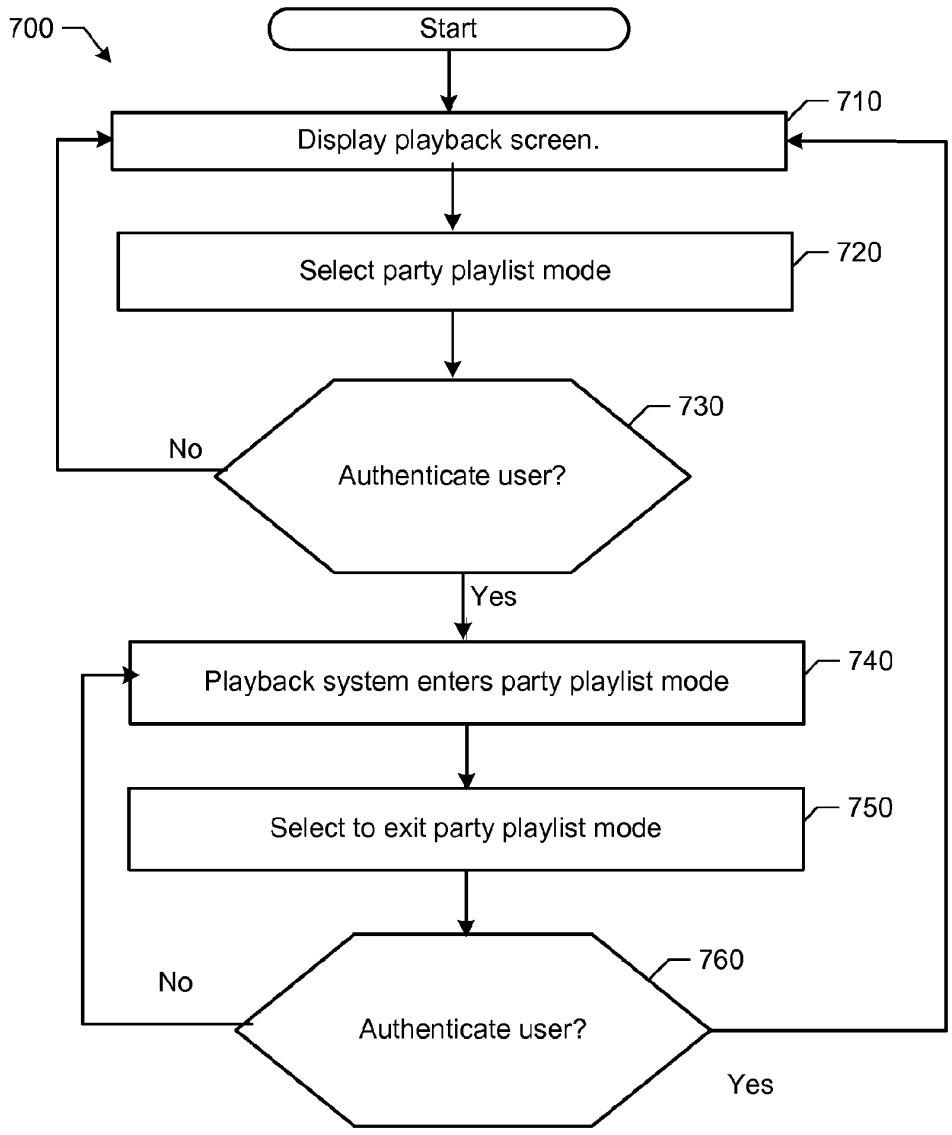

700
Start
710
Display playback screen.
720
Select party playlist mode
730
No
Authenticate user?
Yes
740
Playback system enters party playlist mode
750
Select to exit party playlist mode
760
No
Authenticate user?
Yes

FIGURE 7

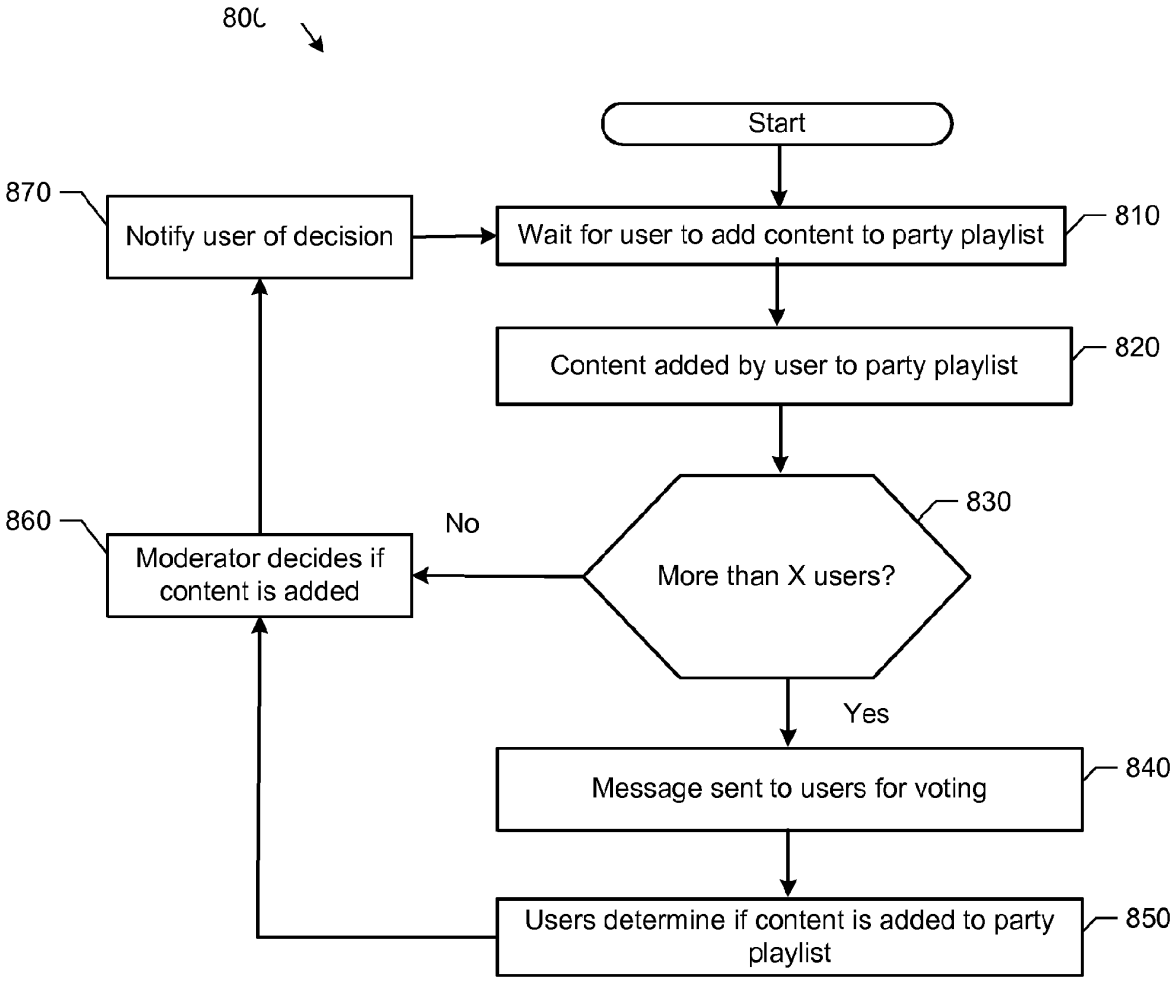

800
Start
870
Notify user of decision
Wait for user to add content to party playlist
810
Content added by user to party playlist
820
830
860
No
Moderator decides if content is added
More than X users?
Yes
Message sent to users for voting
840
Users determine if content is added to party playlist
850

FIGURE 8

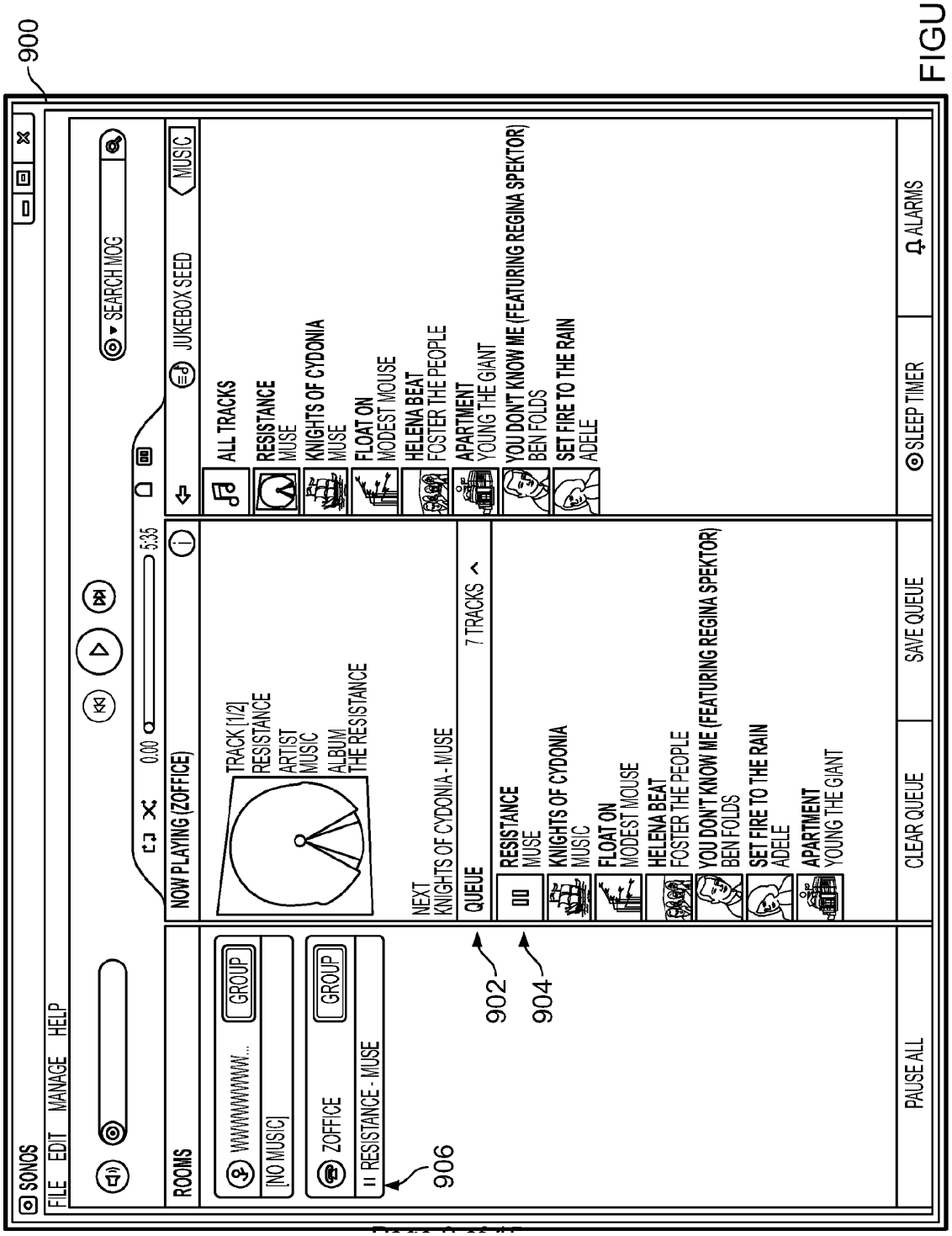


FIGURE 9

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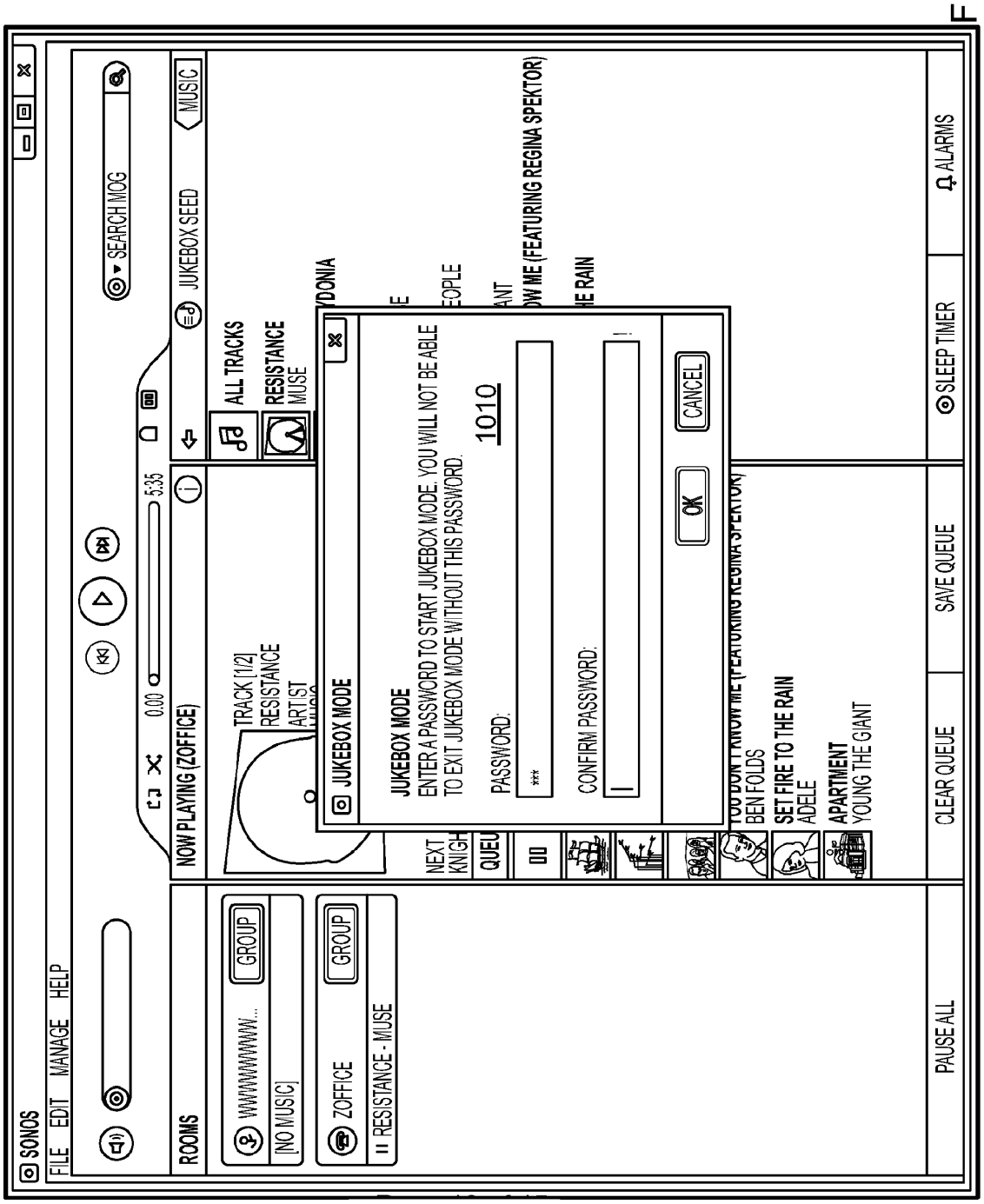

SONOS
FILE EDIT MANAGE HELP
SEARCH MOG
ROOMS
NOW PLAYING (ZOFFICE)
JUKEBOX SEED
MUSIC
ALL TRACKS
RESISTANCE
MUSE
JUKEBOX MODE
ENTER A PASSWORD TO START JUKEBOX MODE. YOU WILL NOT BE ABLE TO EXIT JUKEBOX MODE WITHOUT THIS PASSWORD.
1010
PASSWORD:
CONFIRM PASSWORD:
OK
CANCEL
SET FIRE TO THE RAIN
ADELE
APARTMENT
YOUNG THE GIANT
PAUSE ALL
CLEAR QUEUE
SAVE QUEUE
SLEEP TIMER
ALARMS

FIGURE 10

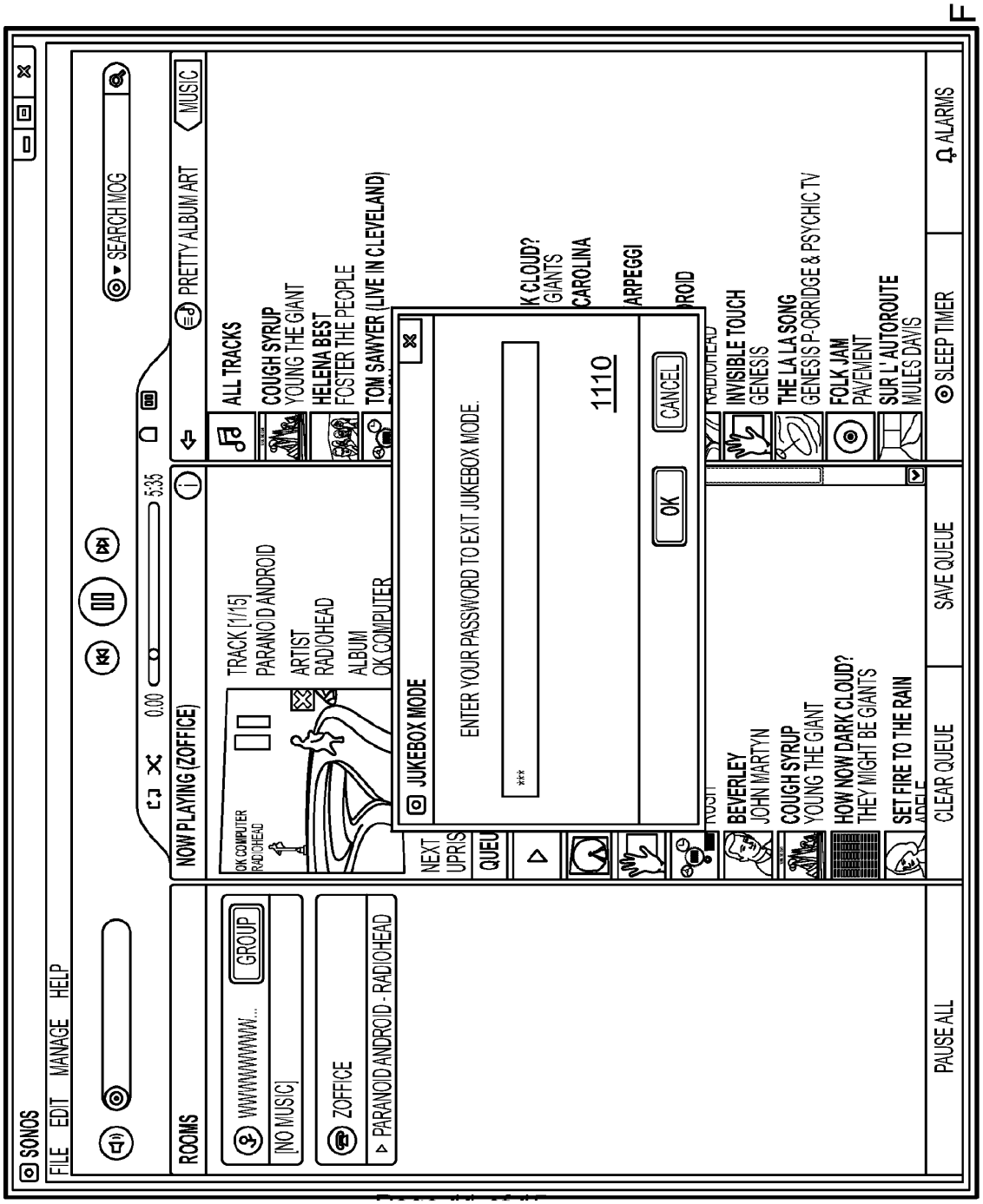

SONOS
FILE EDIT MANAGE HELP
SEARCH MOG
ROOMS
NOW PLAYING (ZOFFICE)
PRETTY ALBUM ART
MUSIC
ALL TRACKS
COUGH SYRUP
YOUNG THE GIANT
HELENA BEST
FOSTER THE PEOPLE
TOM SAWYER (LIVE IN CLEVELAND)
TRACK [1/15]
PARANOID ANDROID
ARTIST
RADIOHEAD
ALBUM
OK COMPUTER
JUKEBOX MODE
ENTER YOUR PASSWORD TO EXIT JUKEBOX MODE.
1110
OK
CANCEL
K CLOUD?
GIANTS
CAROLINA
ARPEGGI
ROID
INVISIBLE TOUCH
GENESIS
THE LA LA SONG
GENESIS P-ORRIDGE & PSYCHIC TV
FOLK JAM
PAVEMENT
SUR L' AUTOROUTE
MULES DAVIS
BEVERLEY
JOHN MARTYN
COUGH SYRUP
YOUNG THE GIANT
HOW NOW DARK CLOUD?
THEY MIGHT BE GIANTS
SET FIRE TO THE RAIN
CLEAR QUEUE
SAVE QUEUE
SLEEP TIMER
ALARMS
PAUSE ALL
ZOFFICE
PARANOID ANDROID - RADIOHEAD
[NO MUSIC]
GROUP

FIGURE 11

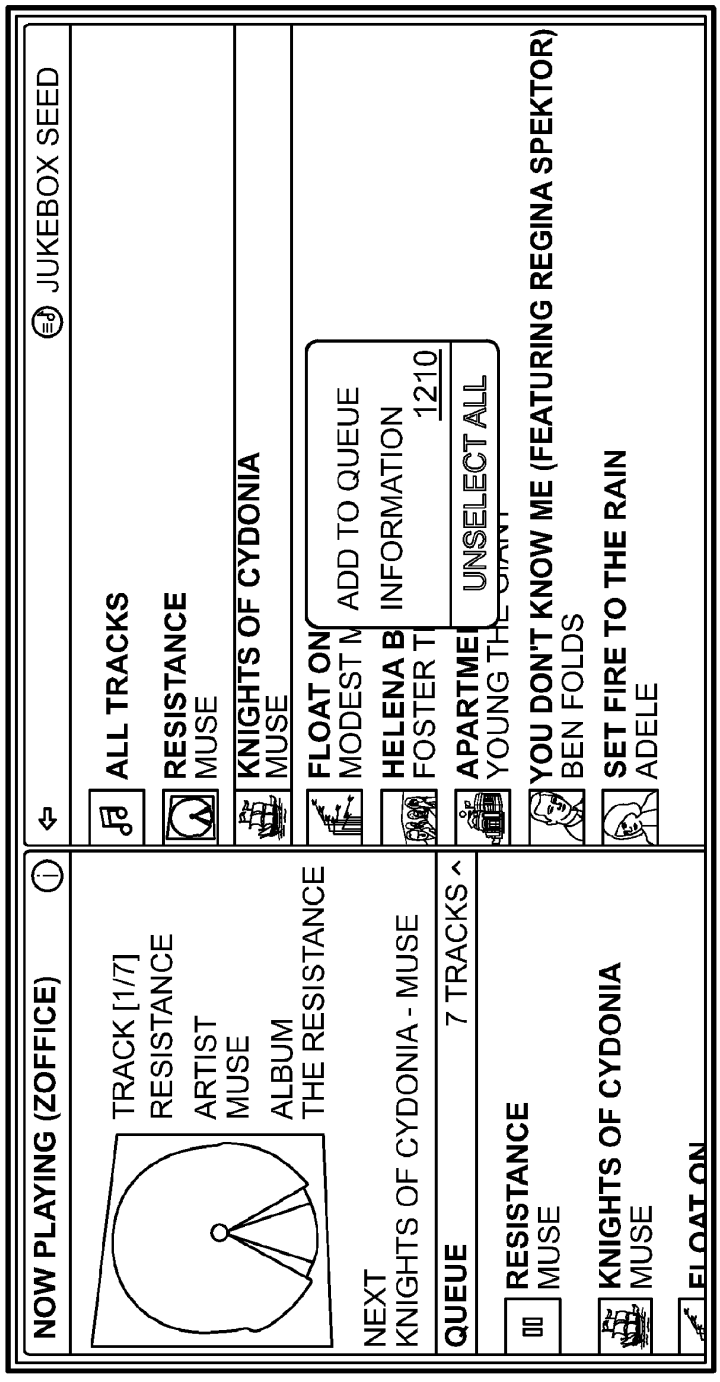

NOW PLAYING (ZOFFICE)
TRACK [1/7]
RESISTANCE
ARTIST
MUSE
ALBUM
THE RESISTANCE
NEXT
KNIGHTS OF CYDONIA - MUSE
QUEUE
7 TRACKS
RESISTANCE
MUSE
KNIGHTS OF CYDONIA
MUSE
JUKEBOX SEED
ALL TRACKS
RESISTANCE
MUSE
KNIGHTS OF CYDONIA
MUSE
FLOAT ON
MODEST M
HELENA B
FOSTER TI
APARTME
YOUNG TH
YOU DON'T KNOW ME (FEATURING REGINA SPEKTOR)
BEN FOLDS
SET FIRE TO THE RAIN
ADELE
ADD TO QUEUE
INFORMATION
1210
UNSELECT ALL

FIGURE 12

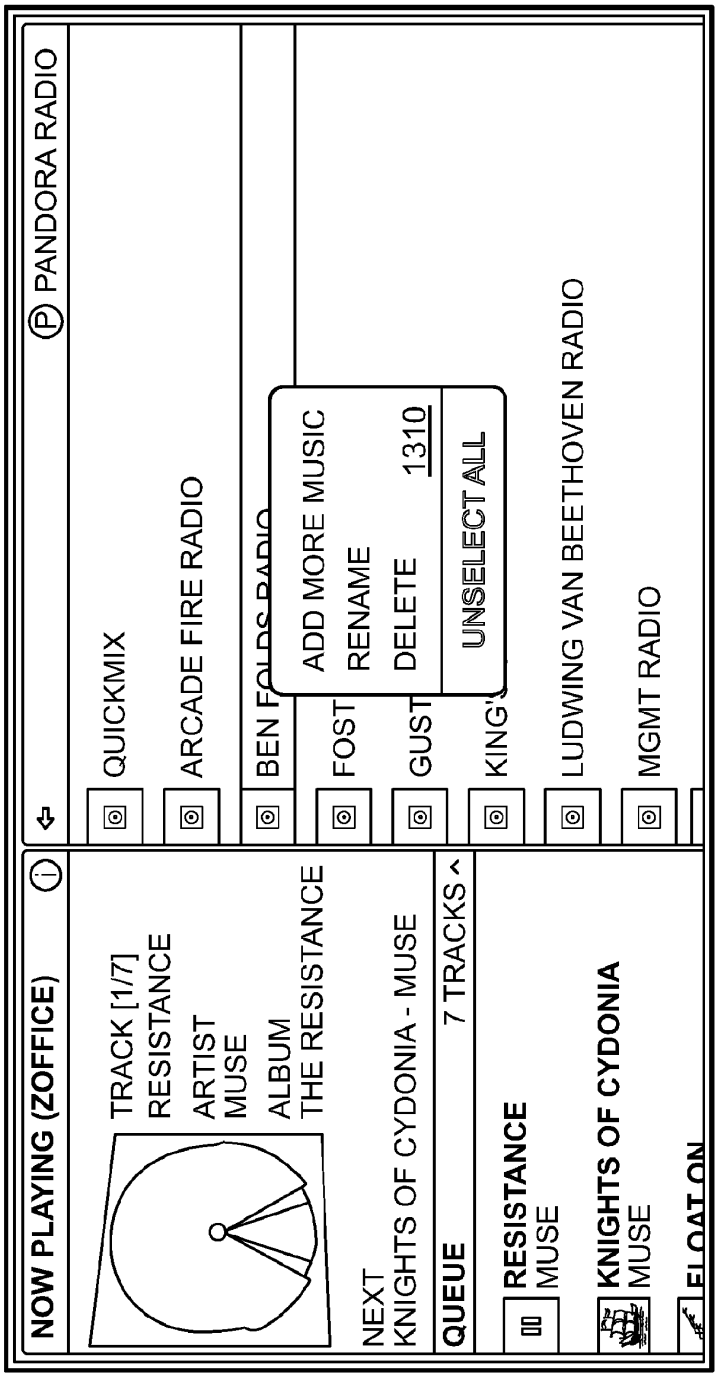


FIGURE 13

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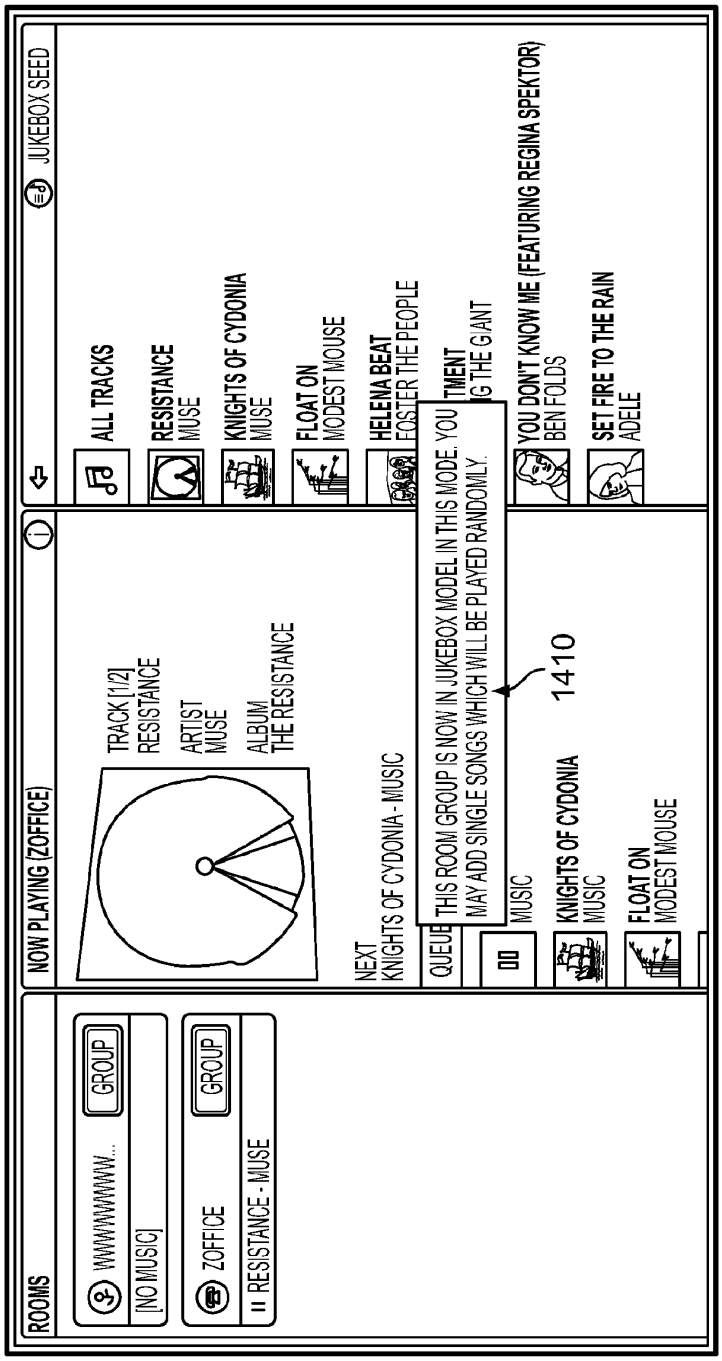


FIGURE 14

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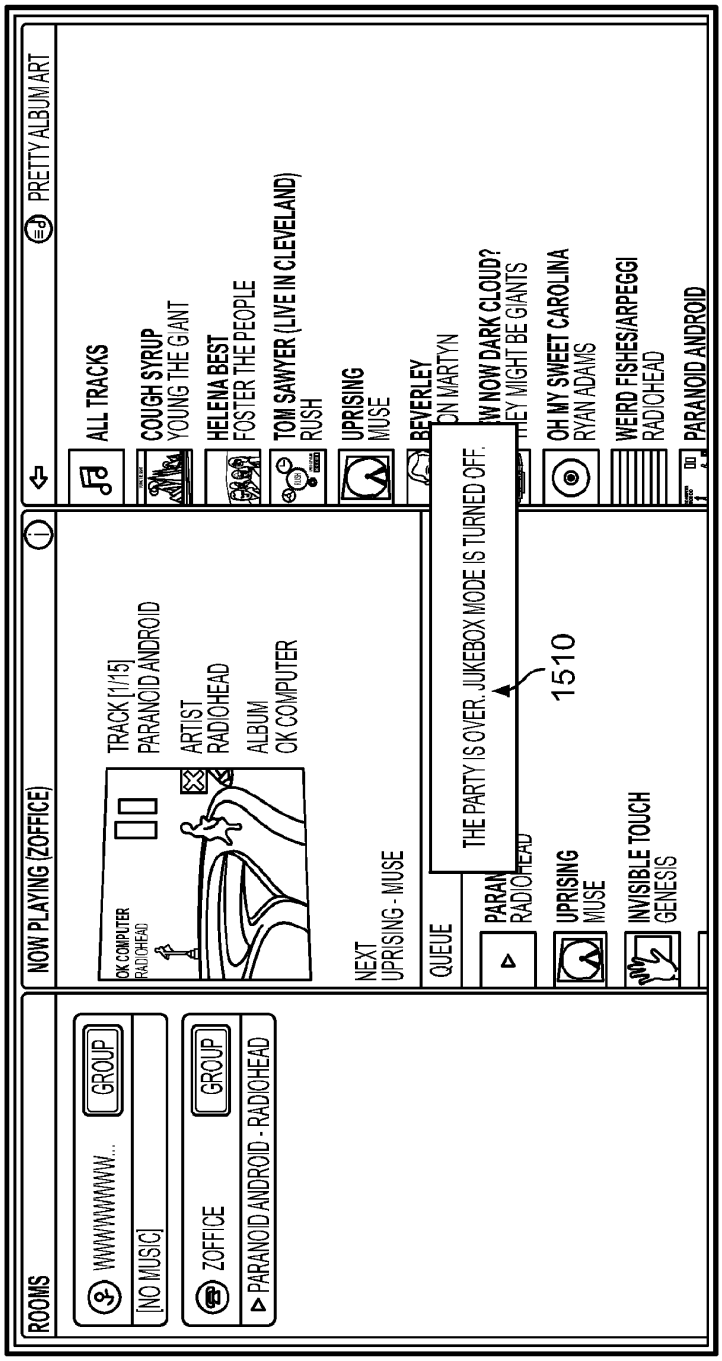


FIGURE 15

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/046386

A. CLASSIFICATION OF SUBJECT MATTER

G06Q 50/10(2012.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06Q 50/10; G06F 15/16; H04N 7/173; G06F 7/00; G06F 17/30; H04L 9/00; H04W 40/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords:playlist, authorization, participate, zone:

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7483958 B1 (TAREK Z. ELABBADY et al.) 27 January 2009 See abstract, column 7, lines 61-66, column 11, lines 1-20, claims 1, 6 and figure 4.	1-21
Y	US 2010-0228740 A1 (ALAN CANNISTRARO et al.) 09 September 2010 See abstract, paragraphs [0009], [0036]-[0037], [0047]-[0057], [0089], claim 1 and figure 4.	1-21
A	US 2012-0129446 A1 (STEVE KO et al.) 24 May 2012 See abstract, paragraphs [0036]-[0037], claim 1 and figure 4.	1-21
A	US 2009-0031336 A1 (TIMOTHY R. CHAVEZ et al.) 29 January 2009 See abstract, paragraph [0021], claim 1 and figure 3.	1-21
A	US 2007-0299778 A1 (RYAN A. HAVESON et al.) 27 December 2007 See abstract, claim 1 and figure 3.	1-21

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search	Date of mailing of the international search report
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(54) Title: AUDIO SYSTEMS AND RELATED DEVICES AND METHODS

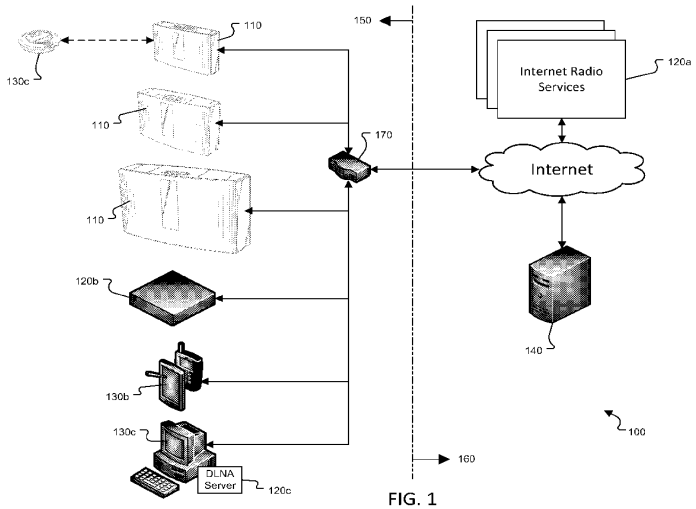


FIG. 1

(57) Abstract: A method for managing presets in an audio system is provided. The method includes syncing preset assignments on a plurality of audio playback devices such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices, and, such that, if one of the preset assignments is changed on one of the audio playback devices, each of the other audio playback devices is automatically updated such that a corresponding change is made to a corresponding preset assignment on each of the other audio playback devices. Each of the preset assignments is an assignment of an entity associated with one of a plurality of digital audio sources to one of a plurality of preset indicators on the corresponding one of the audio playback devices.

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AUDIO SYSTEMS AND RELATED DEVICES AND METHODS

BACKGROUND

[0001] This disclosure relates to audio systems and related devices and methods, and, particularly, to managing (e.g., synchronizing) presets among devices in an audio system.

SUMMARY

[0002] All examples and features mentioned below can be combined in any technically possible way.

[0003] In one aspect, a method for managing presets in an audio system is provided. The method includes syncing preset assignments on a plurality of audio playback devices such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices, and, such that, if one of the preset assignments is changed on one of the audio playback devices, each of the other audio playback devices is automatically updated such that a corresponding change is made to a corresponding preset assignment on each of the other audio playback devices. Each of the preset assignments is an assignment of an entity associated with one of a plurality of digital audio sources to one of a plurality of preset indicators on the corresponding one of the audio playback devices.

[0004] Implementations may include one of the following features, or any combination thereof.

[0005] In some implementations, the step of syncing preset assignments on a plurality of audio playback devices includes receiving information from a first audio playback device of the audio system regarding a change to one or more of a plurality of preset assignments; updating stored preset data based on the information received from the first audio playback device; and providing update information to one or more other audio playback devices of

the audio system such that the one or more other audio playback devices update their respective preset assignments to correspond to those of the first audio playback device.

[0006] In certain implementations, the step of updating stored preset data includes updating preset data stored on a remote server.

[0007] In some implementations, the step of updating stored preset data includes replacing a first set of preset assignments with a second, updated set of preset assignments.

[0008] In certain implementations, the method also includes receiving user input regarding the assignment of an entity associated with one of the digital audio sources to one of the preset indicators on a first one of the audio playback devices.

[0009] In some implementations, the user input corresponds to actuation of a hardware button on a first one of the audio playback devices.

[0010] In certain implementations, the user input is received via a controller connected to the first one of the audio playback devices via a network connection.

[0011] In some implementations, the assignable entities include at least (i) user-defined playlists of digital music and (ii) Internet radio stations.

[0012] The digital audio sources may include a plurality of Internet radio sites, and the entities may include individual radio stations provided by the Internet radio sites.

[0013] In certain implementations, the preset indicators provide access to their respectively assigned entities in the same manner irrespective of the associated digital audio source.

[0014] In some implementations, the preset indicators provide for single press access to the respectively assigned entities, irrespective of the digital audio source.

[0015] In another aspect, an audio system server includes a processor, and instructions stored on a computer-readable media that. When executed, the instructions cause the processor to: receive information from a first audio playback device of an audio system regarding a change to one or more of a plurality of preset assignments; update stored preset data based on the information received from the first device; and to provide update information to one or more other audio playback devices of the audio system such that each of the one or more other audio playback devices update their respective preset assignments to correspond to those of the first audio playback device. Each of the preset assignments represents an assignment of an entity associated with one of a plurality of digital audio sources to a corresponding preset indicator.

[0016] Implementations may include one of the above and/or below features, or any combination thereof.

[0017] In some implementations, the audio system server is a cloud-based server.

[0018] In certain implementations, the instructions, when executed, cause the processor to provide the update information to the one or more other audio playback devices in response to communication received from the one or more other audio playback devices requesting the update information.

[0019] In some implementations, the update information is an updated list of preset assignments.

[0020] In certain implementations, the instructions, when executed, cause the processor to: maintain a global recents list. The global recents list is a list of entities that is populated from content that the user has chosen to play on one or more of the audio playback devices.

[0021] In some implementations, the instructions, when executed, cause the processor to: receive information from a first audio playback device of an audio system regarding selection of a first entity for providing streamed music; update stored recent data based on

the information received from the first device; and to provide updated recents information to one or more other audio playback devices of the audio system such that each of the one or more other audio playback devices updates a locally stored recents list to correspond to a recents list stored on the first audio playback device.

[0022] In certain implementations, the instructions, when executed, cause the processor to: receive a copy of a token from a first audio playback device of an audio system, wherein the token is a unique identifier that a corresponding one of the digital audio sources recognizes and associates with a user account, thereby to provide access to the user account; store the copy of the token within the audio system server; and to provide copies of the token other audio playback devices of the audio system such that the corresponding one of the digital audio sources can recognize the other audio playback devices as being associated with the user account.

[0023] A further aspect features an audio system that includes i) a plurality of audio playback devices, and ii) a remote server. Each audio playback device is configured to operatively connect to a plurality of digital audio sources for playback of content from the digital audio sources. Each of the audio playback devices includes a set of preset indicators. Each preset indicator in the set of preset indicators is configured to have assigned to it an entity associated with one of the plurality of digital audio sources. The remote server is configured to receive information from one of the audio playback devices regarding changes to preset assignments. Each of the preset assignments represents an assignment of an entity associated with one of the digital audio sources to a corresponding one of the preset indicators. The remote server is further configured to update a stored set of global preset assignments based on the information received; and to distribute update information to the other ones of the audio playback devices regarding changes to the global preset assignments. The other ones of the audio playback devices are configured to update their respective preset assignments based on the update information distributed from the remote server such that, following the update, all of the audio playback devices of the plurality of audio playback devices have the same preset assignments.

[0024] Implementations may include one of the above and/or below features, or any combination thereof.

[0025] In some implementations, the information received from the one of the audio playback devices is an updated set of global preset assignments.

[0026] In certain implementations, the remote server is configured to update the stored set of global preset assignments by replacing the stored set of global preset assignments with the updated set of global preset assignments.

[0027] In some implementations, the remote server is configured to distribute the update information to the other ones of the audio playback devices in response to requests for update information received from the other ones of the audio playback devices.

[0028] In certain implementations, the set of preset indicators are hardware buttons.

[0029] The preset indicators may include numerical identifiers.

[0030] Yet another aspect provides an audio playback device that is configured to operably connect to a plurality of digital audio sources. The audio playback device includes a digital-to-analog converter that is configured to receive a digital representation of content from the digital audio sources and convert to analog form; an electro-acoustic transducer; a set of user-selectable preset indicators. Each indicator in the set of preset indicators is configured to have assigned to it an entity associated with the plurality of digital audio sources. The audio playback device also includes a processor and instructions stored on a computer-readable media. The instructions, when executed, cause the processor to: update one or more preset assignments based on user input, and to cause the processor to send information regarding the update to the one or more preset assignments to a remote server. Each of the preset assignments represents an assignment of an entity associated with one of the digital audio sources to a corresponding one of the preset indicators.

[0031] Implementations may include one of the above and/or below features, or any combination thereof.

[0032] In some implementations, the audio playback device also includes an enclosure. The digital-to-analog converter and the electro-acoustic transducer are located within the enclosure and the set of user-selectable present indicators is located on the enclosure.

[0033] In certain implementations, the digital audio sources include at least (i) one or more libraries of user-defined playlists of digital music files and (ii) Internet radio sites.

[0034] In some implementations, the instructions, when executed, cause the processor to: notify one or more other audio playback devices within an audio system regarding the update to the one or more preset assignments.

[0035] In certain implementations, the instructions, when executed, cause the processor to: receive notification from an other audio playback device within an audio system regarding changes to preset assignments on the other audio playback device; and, in response to receiving the notification regarding changes to the preset assignments on the other audio playback device, to contact a remote server for the audio system to request update information; and to update one or more preset assignments on the audio playback device based on the update information received from the remote server such that preset assignments on the audio playback devices correspond to respective preset assignments on the other audio playback device.

[0036] According to another aspect, an audio playback device is configured to operably connect to a plurality of digital audio sources. The audio playback device includes a digital-to-analog converter configured to receive a digital representation of content from the digital audio sources and convert to analog form; an electro-acoustic transducer; and a set of user-selectable preset indicators. Each indicator in the set of preset indicators is configured to have assigned to it an entity associated with the plurality of digital audio sources. The audio playback device also includes a processor and instructions stored on a computer-readable media. The instructions, when executed, cause the processor to:

update one or more preset assignments based on user input; and to notify one or more other audio playback devices within an audio system regarding the update to the one or more preset assignments. Each of the preset assignments represents an assignment of an entity associated with one of the digital audio sources to a corresponding one of the preset indicators.

[0037] Implementations may include one of the above and/or below features, or any combination thereof.

[0038] In some implementations, the digital audio sources include at least (i) one or more libraries of user-defined playlists of digital music files and (ii) Internet radio sites.

[0039] In certain implementations, the assignable entities include at least individual Internet radio stations and particular user-defined playlists of digital music files.

[0040] In some implementations, the digital audio sources include a plurality of Internet radio sites, and the entities include individual radio stations provided by the Internet radio sites.

[0041] In certain implementations, the instructions, when executed, cause the processor to: receive notification from an other audio playback device within an audio system regarding changes to preset assignments on the other audio playback device; and, in response to receiving the notification regarding changes to the preset assignments on the other audio playback device, to contact a remote server for the audio system to request update information; and to update one or more preset assignments on the audio playback device based on the update information received from the remote server such that preset assignments on the audio playback devices correspond to respective preset assignments on the other audio playback device.

[0042] In a further aspect, an audio playback device is configured to operably connect to a plurality of digital audio sources. The audio playback device includes a digital-to-analog converter configured to receive a digital representation of content from the digital

audio sources and convert to analog form; an electro-acoustic transducer; and a set of user-selectable preset indicators. Each indicator in the set of preset indicators is configured to have assigned to it an entity associated with the plurality of digital audio sources. The audio playback device also includes a processor and instructions stored on a computer-readable media. The instructions, when executed, cause the processor to receive notification from an other audio playback device within an audio system regarding changes to preset assignments on the other audio playback device; and, in response to receiving the notification regarding changes to the preset assignments on the other audio playback device, to contact a remote server for the audio system to request update information; and to update one or more preset assignments on the audio playback device based on the update information received from the remote server such that preset assignments on the audio playback devices correspond to respective preset assignments on the other audio playback device. Each of the preset assignments represents an assignment of an entity associated with one of the digital music sources to a corresponding one of the preset indicators.

[0043] In yet another aspect, an audio system includes i) a plurality of audio playback devices, and ii) a software program configured to run on a separate device (e.g., a separate computer, smartphone, tablet, etc.). Each audio playback device is configured to operatively connect to a plurality of digital audio sources for playback of content from the digital audio sources. Each of the audio playback devices includes a set of preset indicators. Each preset indicator in the set of preset indicators is configured to have assigned to it an entity associated with one of the plurality of digital audio sources. The software program provides a user interface configured to present an audio playback device selection region that enables user to select one of the audio playback devices to control with the separate computer. The user interface is further configured to present a set of preset indicators that corresponds to the set of preset indicators of the selected one of the audio playback devices, and to present a source selection region that enables a user to select an entity to assign to one of the preset indicators of the selected one of the audio playback devices.

[0044] Implementations may include one of the above and/or below features, or any combination thereof.

[0045] In some implementations, the source selection region also enables a user to select an entity to provide audio content to the selected one of the audio playback devices for playback of the audio content.

[0046] In certain implementations, the user interface is further configured to present a global recents. The global recents list is a list of entities that is populated from audio content that the user has chosen to play on one or more of the audio playback devices.

[0047] In some implementations, the software program includes instructions to procure the global recents list from data stored on the selected one of the audio playback devices.

[0048] In certain implementations, the user interface is further configured to enable a user to select whether the preset assignments are to be global or local. The global preset assignments are synchronized across the plurality of audio playback devices such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices, and, such that, if one of the preset assignments is changed on one of the audio playback devices, each of the other audio playback devices is updated such that a corresponding change is made to a corresponding preset assignment on each of the other audio playback devices. The local preset assignments are device-specific such that each of the audio playback devices can have a unique set of preset assignments and such that the preset assignments on any one of the audio playback devices do not necessarily correspond to the preset assignments on any of the other audio playback devices.

[0049] Another aspect features a computer-implemented method that includes storing a set of local preset assignments for each of a plurality of audio playback devices of an audio system. The local preset assignments are device-specific such that the local preset assignments for any one of the audio playback devices do not necessarily correspond to the local preset assignments for any of the other audio playback devices. The method also

includes receiving input regarding a change from a local setting to a global setting; receiving input regarding selection of one of the audio playback devices to serve as a master audio playback device; setting the set of stored local preset assignments associated with the selected, master audio playback device as a set of global preset assignments; and providing the global preset assignments to the other playback devices of the audio system so as to synchronize the preset assignments across the audio system, such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0050] FIG. 1 is a schematic view of an audio system that facilitates synchronization of presets among various system devices.

[0051] FIG. 2 is a swim lane diagram showing steps of managing/synchronizing “global” presets within the audio system of FIG. 1.

[0052] FIG. 3 is a swim lane diagram showing steps of managing “local” presets within the audio system of FIG. 1.

[0053] FIG. 4 is a screen shot of a user interface provided by a controller which displays a recents list within the audio system of FIG. 1.

[0054] FIG. 5 is a swim lane diagram showing steps of managing/synchronizing “global” recents within the audio system of FIG. 1.

[0055] FIG. 6 is a swim lane diagram showing steps for management of “local” recents within the audio system of FIG. 1.

[0056] FIG. 7A and 7B are perspective and top plan views, respectively, of an exemplary audio playback device from the audio system of FIG. 1.

[0057] FIG. 7C is a block diagram of the audio playback device of FIG. 7A.

[0058] FIG. 8 is a swim lane diagram showing steps for browsing entities associated with one of the digital audio sources within the audio system of FIG. 1.

[0059] FIG. 9 is a block diagram of another implementation of an audio playback device that can be utilized in the audio system of FIG. 1.

[0060] FIG. 10 is a block diagram of an exemplary controller from the audio system of FIG. 1.

[0061] FIG. 11 is a block diagram of a software program for the controller of FIG. 10.

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[0062] FIG. 12 is a state interaction diagram that shows an overview of four user interface states of a user application of the controller software program of FIG. 11.

[0063] FIG. 13 illustrates a high-level workflow for a setup state from the state interaction diagram of FIG. 12.

[0064] FIG. 14A is a swim lane diagram showing steps for music setup for an Internet music service within the audio system of FIG. 1.

[0065] FIG. 14B is a swim lane diagram showing steps for distribution of tokens for accessing account based digital audio sources such as certain Internet music services within the audio system of FIG. 1.

[0066] FIG. 15A and 15B show a graphical user interface for a main application state, from the state interaction diagram of FIG. 12, in a “Now Playing” mode and an “Explore” mode, respectively, which may be suitable for a controller in the form of a desktop or laptop computer.

[0067] FIG. 15C is the user interface of FIG. 15B showing a sub-list of entities associated with an audio source named “Global Internet Radio”.

[0068] FIG. 16A, 16B, and 16C show an alternative implementation of a user interface for the main application state in a “Preset” mode, a “Now Playing” mode, and an “Explore” mode, respectively, which may be suitable for a controller in the form of mobile device such as a smart phone.

[0069] FIG. 17 illustrates a process flow for setting preset from a controller within the audio system of FIG. 1.

[0070] FIGS. 18A and 18B show a sequence of screen displays illustrating the setting of a preset assignment, by selecting and holding a preset indicator, in the “Now Playing” mode on a desktop or laptop computer.

[0071] FIGS. 19A and 19B show a sequence of screen displays illustrating the setting of a preset assignment, by right-clicking on one the preset indicators and selecting “Set Preset” from a right-click menu, in the “Now Playing” mode on a desktop or laptop computer.

[0072] FIGS. 20A and 20B show a sequence of screen displays illustrating the setting of a preset assignment, by selecting a preset indicator from a preset menu, in the “Now Playing” mode on a desktop or laptop computer.

[0073] FIGS. 21A through 21C show a sequence of screen displays illustrating the setting of a preset assignment, by drag and drop, in the “Now Playing” mode on a desktop or laptop computer.

[0074] FIGS. 22A and 22B show a sequence of screen displays illustrating the setting of a preset assignment, by drag and drop, in the “Explore” mode on a desktop or laptop computer.

[0075] FIG. 23 is a block diagram of a computing device that can be used to implement the server of the audio system of FIG. 1.

DETAILED DESCRIPTION

[0076] This disclosure is based, at least in part, on the realization that it can be beneficial to synchronize presets among various devices within an audio system. It may be further beneficial to curate a list of recently access entities for providing audio content which can be shared among various devices within an audio system. Such features can help to facilitate quick and easy access to a user's preferred audio content.

[0077] SYSTEM OVERVIEW

[0078] Referring to FIG. 1, an audio system 100 for the delivery of digital audio (e.g., digital music) provides for easy, quick access to a variety of digital audio sources through the use of preset assignments. At a very high level, there are four main categories of devices in the audio system 100: (i) audio playback devices 110; (ii) digital audio sources 120a, 120b, 120c (collectively referenced as 120); controllers 130a, 130b, 130c (collectively referenced as 130); and a server 140.

[0079] The audio playback devices 110 are electronic devices which are capable of rendering audio content. These devices can access stored audio content (e.g., remotely stored audio content) and stream it for playback. In some cases, the audio playback devices 110 may also be capable of playing locally stored content. These devices render audio with the help of audio codecs and digital signal processors (DSPs) available within.

[0080] The audio playback devices 110 can communicate with each other. For example, each audio playback device 100 can communicate with the other audio playback devices 110 within the audio system 100 for synchronization. This can be a synchronization of device settings, such as synchronization of preset assignments, or, for synchronization of playback (e.g., such that all or a subset of the audio playback devices 110 play the same content simultaneously and synchronously).

[0081] The digital audio sources 120 are devices and/or services that provide access to one or more associated entities for supplying content (e.g., audio streams) to the audio playback devices 110, and which can be located remotely from the audio playback devices

110. An "entity," as used herein, refers to a grouping or collection of content for playback. Exemplary entities include Internet radio stations and user defined playlists. "Content" is data (e.g., an audio track) for playback. "Associated entity" refers to an entity that is associated with a particular audio source. For example, if the digital audio source 120 is an Internet music service such as Pandora®, an example associated entity would be a radio station provided by Pandora®.

[0082] For the purposes of the audio system 100, audio streams are considered to be data. They are processed as digital information that is converted to analog before presentation. Data streaming is the method by which data is moved from an audio source 120 to an audio playback device 110. Typically, there are two models for this data movement, push and pull. The audio system 100 is capable of managing this audio (data) streaming in both fashions; descriptions of these processes are as follows.

[0083] In a push model, the digital audio source 120 will move the data to the audio playback device 110 at a pace that it desires. The recipient (e.g., one of the audio playback devices 110) of the data will acknowledge the data and the digital audio source 120 will provide more data. This model requires the digital audio source 120 to be managing the throughput characteristics of the audio system 100. In a pull model, the audio playback device 110 will request data from the digital audio source 120 at a rate it desires. This allows the audio playback device 110 to read ahead if data is available.

[0084] The digital audio sources 120 each maintain a repository of audio content which can be chosen by the user to play. The digital audio sources 120 can be based on the Digital Living Network Alliance® (DLNA) or other Web based protocols similar to the Hypertext Transfer Protocol (HTTP). Some of the devices and services in this category include Internet based music services 120a such as Pandora®, Spotify®, and vTuner®; network-attached storage (NAS) devices 120b, and a media server daemon 120c (e.g., provided as a component of a computer-based controller).

[0085] The digital audio sources 120 include user defined playlists of digital music files available from network audio sources such as network-attached storage (NAS) devices

120b, and a DLNA server 120c which may be accessible to the audio playback devices 110 over a local area network such as a wireless (Wi-Fi) or wired (Ethernet) home network 150, as well as Internet radio sites 120a such as Pandora®, vTuner®, Spotify®, etc., which are accessible to the audio playback devices 110 over a wide area network 160 such as the Internet.

[0086] The controllers 130 are responsible for controlling the audio playback devices 110 and for browsing the audio sources 120 in the audio system 100. Some of the devices in this category include desktop computers, laptop computers, and mobile devices such as smart phones and tablets. These devices control the audio playback devices 110 via a wireless communication interface (e.g., IEEE 802.11 b /g, Bluetooth LE, infrared, etc.). The controllers 130 serve as an online management tool for a user's network enabled audio playback devices 110. The controllers 130 provide interfaces which enable to the user to perform one or more of the following: setup a connection to a Wi-Fi network; create an audio system account for the user, sign into a user's audio system account and retrieve information; add or remove an audio playback device 110 on a user's audio system account; edit an audio playback device's name, and update software; access the audio sources (via the audio playback devices 110); assign an entity (e.g., a playlist or radio station) associated with one of the audio sources 120 to a preset indicator; browse and select recents, where "recents" refers to recently accessed entities; use transport controls (play/pause, next/skip, previous), view "Now Playing" (i.e., content currently playing on an audio playback device 110) and album art; and adjust volume levels.

[0087] In some cases, the controllers 130 may include network controllers 130a, 130b and auxiliary controllers 130c. The network controllers 130a, 130b are controllers that communicate with the audio playback devices 110 over a wireless (Wi-Fi) network connection. The network controllers can include primary network controllers 130a and secondary network controllers 130b. The primary network controllers 130a can be utilized for: connecting an audio playback device 110 to a Wi-Fi network (via a USB connection between the audio playback device 110 and the primary network controller 130a); creating a system account for the user; setting up music services; browsing of content for playback;

setting preset assignments on the audio playback devices 110; transport control (e.g., play/pause, fast forward/rewind, etc.) for the audio playback devices 110; and selecting audio playback devices 110 for content playback (e.g., single room playback or synchronized multi-room playback). Devices in the primary network controller category can include desktop and laptop computers.

[0088] The secondary network controllers 130b may offer some, but not all, of the functions of the primary network controllers 130a. For example, the secondary network controllers 130b may not provide for all of the account setup and account management functions that are offered by the primary network controllers 130a. The secondary network controllers 130b may be used for: music services setup; browsing of content; setting preset assignments on the audio playback devices; transport control of the audio playback devices; and selecting audio playback devices 110 for content playback: single room or synchronized multi-room playback. Devices in the secondary network controller category can include mobile devices such as smart phones and tablets.

[0089] The auxiliary controllers 130c communicate wirelessly (e.g., via Bluetooth low energy (BTLE) or IR) with an associated (e.g., paired) one of the audio playback devices (item 110, FIG. 1). The auxiliary controllers 130c may offer limited functionality. The auxiliary controllers 130c may be used for: browsing of content; setting of preset assignments on the associated one of the audio playback devices 110; and transport control (play/pause, etc.) of the associated audio playback device.

[0090] The server 140 is a cloud-based server which contains (e.g., within an account database) information related to a user's audio system account. This includes user account information such as the list of the audio playback devices 110 within the system 100, device diagnostic information, preset assignments, etc. The server 140 will be connected to by the audio playback devices 140 and by the controllers 130 (e.g., by primary network controllers) for the purpose of preset management, as well as management of audio sources 120 and management of the user's audio system account.

Generally, the controllers 130 (e.g., network controllers 130a, 130b) will login to the server 140 with a user's login details and 'sync down' the required information to work with.

[0091] The audio playback devices 110 and one or more of the controllers 130 are coupled to a local area network (LAN) 150. Other devices such as one or more of the digital audio sources (e.g., a network-attached storage (NAS) device 120b) may also be coupled to the LAN 150. The LAN 150 may be a wired network, a wireless network, or a combination thereof. In one example, the devices (e.g., audio playback devices 110 and controllers 130 (e.g., primary and secondary controllers 130a, 130b)) within the LAN 150 are wirelessly coupled to the LAN 150 based on an industry standard such as IEEE 802.11 b/g. The LAN 150 may represent a network within a home, an office, or a vehicle. In the case of a residential home, the audio playback devices 110 may be arranged in different rooms (e.g., kitchen, dining room, basement, etc.) within the home. The devices within the LAN 150 connect to a user supplied access point 170 (e.g., a router) and subsequently to a wide area network (WAN) 160 (e.g., the Internet) for communication with the other digital audio sources 120 (Internet based music services 120a) and the server 140.

[0092] Notably, the audio system 100 can provide for the management of presets (a/k/a preset assignments) and recents. Presets are a set of (e.g., six) user-defined shortcuts to content, intended to provide quick access to entities associated with the digital music sources 120 from (1 of 6) preset indicators present on each of the audio playback devices 110. In some cases, the preset indicators can be hardware buttons. Alternatively, the preset indicators may be virtual buttons defined by regions on a touch sensitive display. The individual preset indicators can be denoted with numerical identifiers.

[0093] The preset indicators the audio playback devices 110 provide access to their respectively assigned entities irrespective of the associated digital audio source. More specifically, the preset indicators can provide for single press access to the respectively assigned entities, irrespective of the digital audio source. That is, a single press of a preset indicator will start the streaming and rendering of content from an entity assigned to that preset indicator regardless of the audio source providing that entity. In that regard, the

presets are said to be source agnostic in that they behave in the same manner regardless of the audio source. In some cases, the single press access can be facilitated with the distribution of tokens for accessing account based audio sources which normally require a user to login with account credentials.

[0094] The presets can be global or local at the user's option. The user can select the global or local option, e.g., during set up of the user's system account. If the user's account is set to provide for global presets, the preset assignments will be synchronized on all the audio playback devices 110 across the audio system 100 such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices (e.g., such that preset indicator "1" on a first one of the audio playback devices is assigned to the same entity as preset indicator "1" on all of the other audio playback devices 110 in the audio system 100), and, such that, if one of the preset assignments is changed on one of the audio playback devices 110, each of the other audio playback devices 110 is automatically updated such that a corresponding change is made to a corresponding preset assignment on each of the other audio playback devices. The synchronization of the preset assignments is managed through a combination of communications between the audio playback devices 110 with the server 140, and communications among the audio playback devices 110 themselves. A copy of the global preset assignments is stored locally on each audio playback device 110 associated with the user's account, and a copy of the global preset assignments is also maintained on the server 140.

[0095] FIG. 2 is a swim lane diagram 200 showing steps of managing/synchronizing "global" presets. "Swim lane" diagrams may be used to show the relationship between the various "actors" in the processes and to define the steps involved in the processes. FIG. 2 (and all other swim lane Figures) may equally represent a high-level block diagram of components of the invention implementing the steps thereof. The steps of FIG. 2 (and all the other FIGS. employing swim lane diagrams) may be implemented on computer program code in combination with the appropriate hardware. This computer program code may be stored on storage media such as a diskette, hard disk, CD-ROM, DVD-ROM or

tape, as well as a memory storage device or collection of memory storage devices such as read-only memory (ROM) or random access memory (RAM). Additionally, the computer program code can be transferred to a workstation over the Internet or some other type of network.

[0096] Referring to FIG. 2, four swim lanes are shown including a lane for one of the controllers 210, a lane for a first one of the audio playback devices 212, a lane for the other audio playback devices 214, and a lane for the server 216. At step 220, a first audio playback device (i.e., a first one of the audio playback devices 110, FIG. 1) receives user input regarding the assignment of an entity associated with one of the digital audio sources to one of the preset indicators on the audio playback device. In some cases, the user provides input directly to the audio playback devices, such as by pressing one of the preset indicators on the audio playback device. Alternatively, the user may provide input via a user interface on a selected one of the controllers (218), and the controller communicates the user input to the first audio playback device (219).

[0097] At step 222, the first audio playback device updates one or more preset assignments based on the user input. Updating can include updating data corresponding to the preset assignments stored locally (e.g., within memory) on the audio playback device.

[0098] At step 224, the first audio playback device sends information regarding the update to the one or more preset assignments to the remote server for updating a set preset assignments stored on the server. The update information may include an updated set of preset assignments. The audio playback devices may communicate with the server via a hypertext transfer protocol. The first audio playback device may, for example, upload the update information to the server via an HTTP POST command.

[0099] The server receives the update information from the first audio playback device (226), and updates a set of preset assignments stored on the server (228). Updating the set of preset assignments can include replacing previously stored data (e.g., a previously

stored set of presets) with the updated information (e.g., an updated set of preset assignments).

[00100] At step 230, the first audio playback device sends a communication to each of the other audio playback devices (e.g., a separate notification to each of the other audio playback devices) in the audio system notifying the other playback devices that there has been a change to one or more preset assignments.

[00101] At step 232, the other audio playback devices receive the notification from the first audio playback device. In response to receiving the notification of change to the preset assignments, the other audio playback devices synchronize their preset assignments with the server. To achieve this synchronization, each of the audio playback devices sends a communication (e.g., an HTTP GET request) to the server requesting update information corresponding to the changes to the preset assignments (234).

[00102] At step 236, the server receives the requests from the other audio playback devices. In response to the requests received from the other audio playback devices, the server responds by providing update information (which may consist of an updated set of preset assignments) to the each of the other audio playback devices (238).

[00103] At step 240, the other playback devices receive the update information from the server. Upon receipt of the update information, the other playback devices update their respective preset assignments (i.e., by updating preset data) (242). Updating can include removing (deleting) old data and replacing with new, updated data. For example, updating can include replacing a previously stored set of preset assignments and replacing with an updated set of preset assignments. Following these steps all of the audio playback devices will have the same preset assignments, and the server will have a copy of the preset assignments.

[00104] Alternatively, if the user elects to set the user's system account to provide for local presets, the preset assignments will be device-specific such that the preset assignments on any one of the audio playback devices 110 will not necessarily correspond

to the preset assignments on any of the other audio playback devices 110. A copy of the respective local preset assignments is stored locally on each audio playback device 110 associated with the user's account, and a copy of the local preset assignments for each audio playback device 110 is also maintained on the server 140.

[00105] FIG. 3 is a swim lane diagram 300 illustrating steps for managing local presets. Three swim lanes are shown including a lane for one of the controllers 310, a lane for a first one of the audio playback devices 312, and a lane for the server 316. At step 320, a selected audio playback device (i.e., a selected one of the audio playback devices 110, FIG. 1) receives user input regarding the assignment of an entity associated with one of the digital audio sources to one of the preset indicators on the audio playback device. In some cases, the user provides input directly to the audio playback devices, such as by pressing one of the preset indicators. Alternatively, the user may provide input via a user interface on one of the controllers (318), and the controller communicates the user input to the selected audio playback device (319).

[00106] At step 322, the selected audio playback device updates one or more preset assignments based on the user input. Updating can include updating data corresponding to the preset assignments stored locally (e.g., within memory) on the selected audio playback device.

[00107] At step 324, the selected audio playback device sends information regarding the update to the one or more preset assignments to the remote server for updating a set of preset assignments stored on the server. The update information may include an updated set of preset assignments. The audio playback devices may communicate with the server via a hypertext transfer protocol. The first audio playback device may, for example, upload the update information to the server via an HTTP POST command.

[00108] The server receives the update information from the selected audio playback device (326), and updates a set of preset assignments stored on the server (328). Updating the set of preset assignments can include replacing previously stored data (e.g., a previously stored set of presets) with the updated information (e.g., an updated set of

preset assignments). When the presets are set to local, the server will maintain (store and update) a separate set of presets for each audio playback device in the audio system.

[00109] The maintenance of a copy of the respective preset assignments for each of the audio playback devices on the server can be beneficial, for example, where the user elects to change from a local setting to a global setting after the individual devices have already been programed with respective preset assignments. In such a situation, the server will prompt the user (e.g., via one of the controllers) to select one of the audio playback devices to serve as a master device. The server can then set the preset assignments for the selected master audio playback device as a set of global preset assignments and can provide the global preset assignments to the other audio playback devices in the audio system so as to synchronize the presets across the audio system.

[00110] The "recents list" (a/k/a "recents") is a list of entities that is populated from content that the user has chosen to play. Recent entities can include Internet radio stations (e.g., for Pandora® and vTuner®), and a "group of tracks" selected for Spotify® and stored music. The "group of tracks" is a "parent" of a currently playing track, based on whatever the user either browsed to or searched for (e.g., Album, Playlist, Genre > All, Artist > All, etc.). The controllers 130, and, in some cases, the audio playback devices 110, can provide access to the recents by displaying the recents list to the user and allowing the user to browse the recents list and select entities therefrom.

[00111] The recents can be limited to a predetermined number of entities (e.g., 50-100 entities). Alternatively or additionally, the recents may be limited by date. For example, the recents may be limited to entities accessed by the user within the last day, month, year, etc., with older entries being purged from the list.

[00112] FIG. 4 is an exemplary user interface 400 which may be provided by one of the controllers 130 (FIG. 1), and which displays the recents list 410. The recents entries can be presented in reverse chronological order. "Now playing" (currently playing) tracks, if any, can be presented at the top of the list when the recents are displayed to the user

(412), and may include an indication of where (i.e., on which of the audio playback devices) they are playing.

[00113] Other entities included in the recents list can be displayed along with an indication of the time since they were last started. Within the same day this can take the format of "X hours" + "Y minutes" + "ago" (414). For one day ago (e.g., between 24 and 48 hours ago), "Yesterday" is displayed (416). For more than one day ago (e.g., 48 hours or more) the time can be display in the format of "X days" + "ago" (418).

[00114] As described below, the controllers 130 can be utilized to control the music selection on the audio playback devices 110 on a device-by-device (i.e., audio playback device by audio playback device) basis. Selecting a "Now Playing" entity from the recents list joins the corresponding music stream if it is not already joined.

[00115] As with the presets, the recents can be global (applied to all audio playback devices associated with a user's account) or local (device-specific) at the user's option. The same local/global toggle can be leveraged for both the presets and the recents. That is, one "global/local" setting can dictate whether the presets and recents are global or local. In some cases, the default setting is "global."

[00116] FIG. 5 is a swim lane diagram 500 showing steps for managing global recents. Four swim lanes are shown in FIG. 5 including a lane for a selected one of the controllers 510, a lane for a first one of the audio playback devices 512, a lane for the other audio playback devices 514, and a lane for the server 516. At step 520, a first audio playback device (i.e., a first one of the audio playback devices 110, FIG. 1) receives user input regarding the selection of an entity associated with one of the audio sources for providing streamed audio. In this regard, the user may provide input via one of the controllers (518), and the controller can communicate the user input to the first audio playback device (519).

[00117] At step 522, the first audio playback device updates a recents list stored locally (e.g., within memory) on that audio playback device to include the recently selected entity.

[00118] At step 524, the first audio playback device sends information regarding the update to the recents list to the remote server for updating a recents list stored on the server. The update information may include an updated recents list. The audio playback devices may communicate with the server via a hypertext transfer protocol. The first audio playback device may, for example, upload the update information to the server via an HTTP POST command.

[00119] The server receives the update information from the first audio playback device (526), and updates a recents list stored on the server (528). Updating the recents list can include replacing previously stored data (e.g., a previously stored recents list) with the updated information (e.g., an updated recents list).

[00120] At step 530, the first audio playback device sends a communication to each of the other audio playback devices (e.g., a separate notification to each of the other audio playback devices) in the audio system notifying the other playback devices that there has been a change to the recents list.

[00121] At step 532, the other audio playback devices receive the notification from the first audio playback device. In response to receiving the notification of change to the recents list, the other audio playback devices synchronize their locally stored copies of the recents list with the server. To achieve this synchronization, each of the audio playback devices sends a communication (e.g., an HTTP GET request) to the server requesting update information corresponding to the changes to the recents list (534).

[00122] At step 536, the server receives the requests from the other audio playback devices. In response to the requests received from the other audio playback devices, the server responds by providing update information (which may consist of an updated recents list) to each of the other audio playback devices (538).

[00123] At step 540, the other playback devices receive the update information from the server. Upon receipt of the update information, the other playback devices update their respective copies of the recents list (i.e., by updating recent data) (542). Updating can

include removing (deleting) old data and replacing with new, updated data. For example, updating can include replacing a previously stored recents list and replacing with an updated recents list. Following these steps all of the audio playback devices will have the same recents list, and the server will have a copy of the recents list.

[00124] When a user browses recents using one of the controllers, the controller will retrieve the recents list stored locally on a selected one of the audio playback devices for display to the user. Thus, when recents are set to global, the user will be presented with the same list of entities regardless of which one of the audio playback devices the user selects to control though the controller.

[00125] FIG. 6 is a swim lane diagram 600 showing steps for managing local recents. Three swim lanes are shown including a lane for one of the controllers 610, a lane for a selected one of the audio playback devices 612, and a lane for the server 616. At step 520, a selected audio playback device (i.e., a selected one of the audio playback devices 110, FIG. 1) receives user input regarding the selection of an entity associated with one of the audio sources for providing streamed audio. In this regard, the user may provide input via one of the controllers (518), and the controller can communicate the user input to the first audio playback device (519).

[00126] At step 522, the selected audio playback device updates a recents list stored locally (e.g., within memory) on that audio playback device to include the recently selected entity.

[00127] At step 524, the selected audio playback device sends information regarding the update to the recents list to the remote server for updating a recents list stored on the server. The update information may include an updated recents list. The audio playback devices may communicate with the server via a hypertext transfer protocol. The first audio playback device may, for example, upload the update information to the server via an HTTP POST command.

[00128] The server receives the update information from the selected audio playback device (526), and updates a recents list stored on the server (528). Updating the recents list can include replacing previously stored data (e.g., a previously stored recents list) with the updated information (e.g., an updated recents list). Thus, when recents are set to local, the user will be presented with the a device specific list of entities that corresponds to the entities that had been most recently accessed by the audio playback device that the user selects to control though the controller. The server will maintain a separate recents list for each audio playback device in the audio system.

[00129] The maintenance of a copy of the respective recents lists for each of the audio playback devices on the server can be beneficial, for example, where the user elects to change from a local setting to a global setting after the individual devices have already curated their respective recents lists. In such a situation, the server can prompt the user (e.g., via one of the controllers) to select one of the audio playback devices to serve as a master device. The server can then set the recents list for the selected master audio playback device as a global recents list and can provide the global recents list to the other audio playback devices in the audio system so as to synchronize the recents list across the audio system.

[00130] AUDIO PLAYBACK DEVICES

[00131] An exemplary audio playback device 110 will now be described in greater detail with reference to FIGS. 7A through 7C. Referring to FIG. 7A, an audio playback device 110 includes an enclosure 710 and on the enclosure 710 there resides a graphical interface 712 (e.g., an OLED display) which can provide the user with information regarding currently playing ("Now Playing") music and information regarding the presets. A screen 714 conceals one or more electro-acoustic transducers 715 (FIG. 7C). The audio playback device 110 also includes a user input interface 716. As shown in FIG. 7B, the user input interface 716 includes a plurality of preset indicators 718, which are hardware buttons in the illustrated example. The preset indicators 718 (numbered 1-6) provide the user with easy, one press access to entities assigned to those buttons. That is, a single

press of a selected one of the preset indicators 718 will initiate streaming and rendering of content from the assigned entity.

[00132] The assigned entities can be associated with different ones of the digital audio sources (items 120a, 120b, 120c, FIG. 1) such that a single audio playback device 110 can provide for single press access to various different digital audio sources. In one example, the assigned entities include at least (i) user-defined playlists of digital music and (ii) Internet radio stations. In another example, the digital audio sources include a plurality of Internet radio sites, and the assigned entities include individual radio stations provided by those Internet radio sites.

[00133] Notably, the preset indicators 718 operate in the same manner, at least from the user's perspective, regardless of which entities are assigned and which of the digital audio sources provide the assigned entities. That is, each preset indicator 718 can provide for single press access to its assigned entity whether that entity is a user-defined playlist of digital music provided by an NAS device or an Internet radio station provided by an Internet music service.

[00134] With reference to FIG. 7C, the audio playback device 110 also includes a network interface 720, a processor 722, audio hardware 724, power supplies 726 for powering the various audio playback device components, and memory 728. Each of the processor 722, the graphical interface 712, the network interface 720, the processor 722, the audio hardware 724, the power supplies 726, and the memory 728 are interconnected using various buses, and several of the components may be mounted on a common motherboard or in other manners as appropriate.

[00135] The network interface 720 provides for communication between the audio playback device 110 and the controller (e.g., items 130a-c, FIG.1), the server (item 140, FIG. 1), the audio sources (items 120, FIG. 1) and other audio playback devices 110 via one or more communications protocols. The network interface 720 may provide either or both of a wireless interface 730 and a wired interface 732. The wireless interface 730 allows the audio playback device 110 to communicate wirelessly with other devices in

accordance with a communication protocol such as such as IEEE 802.11 b/g. The wired interface 732 provides network interface functions via a wired (e.g., Ethernet) connection.

[00136] In some cases, the network interface 720 may also include a network media processor 734 for supporting Apple AirPlay® (a proprietary protocol stack/suite developed by Apple Inc., with headquarters in Cupertino, California, that allows wireless streaming of audio, video, and photos, together with related metadata between devices). For example, if a user connects an AirPlay® enabled device, such as an iPhone or iPad device, to the LAN 150, the user can then stream music to the network connected audio playback devices 110 via Apple AirPlay®. A suitable network media processor is the DM870 processor available from SMSC of Hauppauge, New York. The network media processor 734 provides network access (i.e., the Wi-Fi network and/or Ethernet connection can be provided through the network media processor 734) and AirPlay® audio. AirPlay® audio signals are passed to the processor 722, using the I^2S protocol (an electrical serial bus interface standard used for connecting digital audio devices), for downstream processing and playback. Notably, the audio playback device 110 can support audio-streaming via AirPlay® and/or DLNA's UPnP protocols, and all integrated within one device.

[00137] All other digital audio coming from network packets comes straight from the network media processor 734 through a USB bridge 736 to the processor 722 and runs into the decoders, DSP, and eventually is played back (rendered) via the electro-acoustic transducer(s) 715.

[00138] The network interface 710 can also include a Bluetooth low energy (BTLE) system-on-chip (SoC) 738 for Bluetooth low energy applications (e.g., for wireless communication with a Bluetooth enabled controller (item 130c, FIG. 1)). A suitable BTLE SoC is the CC2540 available from Texas Instruments, with headquarters in Dallas, Texas.

[00139] Streamed data pass from the network interface 720 to the processor 722. The processor 722 can execute instructions within the audio playback device (e.g., for performing, among other things, digital signal processing, decoding, and equalization functions), including instructions stored in the memory 728. The processor 722 may be

implemented as a chipset of chips that include separate and multiple analog and digital processors. The processor 722 may provide, for example, for coordination of other components of the audio playback device 110, such as control of user interfaces, applications run by the audio playback device 110. A suitable processor is the DA921 available from Texas Instruments.

[00140] The processor 722 provides a processed digital audio signal to the audio hardware 724 which includes one or more digital-to-analog (D/A) converters for converting the digital audio signal to an analog audio signal. The audio hardware 724 also includes one or more amplifiers which provide amplified analog audio signals to the electroacoustic transducer(s) 715 for playback. In addition, the audio hardware 724 may include circuitry for processing analog input signals to provide digital audio signals for sharing with other devices in the acoustic system 100.

[00141] The memory 728 stores information within the audio playback device 110. In this regard, the memory 728 may store account information, such as the preset and recent information discussed above. The memory 728 may also provide storage for "tokens" for facilitating single press access to the digital audio sources 120 (e.g., the Internet radio services of FIG. 1). A token, as used herein, is a unique identifier that may be provided by the digital audio source 120 and which allows the digital audio source 120 to recognize the audio playback device 110 as being associated with a user's account with the digital audio source 120 and without requiring the user to enter credentials (e.g., user name, password, etc.) each time the audio playback device 110 attempts to access the digital audio source 120.

[00142] The memory 728 may include, for example, flash memory and/or non-volatile random access memory (NVRAM). In some implementations, instructions (e.g., software) are stored in an information carrier. The instructions, when executed by one or more processing devices (e.g., the processor 722), perform one or more processes, such as those described above (e.g., with respect to FIGS. 2, 3, 5, and 6). The instructions can also be stored by one or more storage devices, such as one or more computer- or

machine-readable mediums (for example, the memory 728, or memory on the processor). The instructions may include instructions for performing decoding (i.e., the software modules include the audio codecs for decoding the digital audio streams), as well as digital signal processing and equalization.

[00143] The instructions may also include instructions for enabling certain "browsing" functionality. That is, at least in some cases, the controllers (items 130a-c, FIG. 1) serve as graphical remote controls for the audio playback devices 110 and do not communicate with the digital audio sources 120 (FIG. 1) directly, but, instead, communicate with the digital audio sources 120 via the audio playback devices 110.

[00144] FIG. 8 is a swim lane diagram 800 showing steps for browsing entities (e.g., stations) associated with one of the digital audio sources (items 120a-c, FIG. 1). Three swim lanes are shown in FIG. 8 including a lane for a selected one of the controllers 810, a lane for a selected one of the audio playback devices 812, and a lane for a selected one of the digital audio sources 813.

[00145] At step 820, the controller receives input from a user requesting a list of stations (entities) from a selected one of the digital audio sources (i.e., a digital audio source, within the audio system, that is selected by the user via a user interface provided by the controller). At step 822, the controller sends the request to a selected one of the audio playback devices (i.e., an audio playback device, within the audio system, that is selected by the user via a user interface provided by the controller).

[00146] At step 824, the selected one of the audio playback devices receives the request from the controller. In response, the audio playback device connects to the selected digital audio source via the router and Internet connection and requests a list of entities (e.g., stations) associated with that source (826).

[00147] At step 828, the selected one of the digital audio sources receives the request from the audio playback device. In response to the request from the audio playback device, the audio source sends a list of available entities to the audio playback device

(830). The audio playback device receives the list of available entities (832) and the audio playback device sends the list of available entities along to the controller (834).

[00148] The controller receives the list of available entities from the audio playback device (836) and displays the list to the user (838).

[00149] FIG. 9 illustrates another implementation of an audio playback device 110' in which the audio playback device hardware is divided between the enclosure 710 and a separate device ("dongle 900"). The dongle 900 can be connected to the enclosure 710 via a wired connection 902. In the illustrated example of FIG. 9, the network interface 720, the processor 722, the audio hardware 724, and the power supplies 726 are located within a housing 904 of the dongle 900. The graphical interface 712 and the user input interface 716 are located on the enclosure 710. The enclosure 710 encloses the electro-acoustic transducer(s) 715 and may also include additional electronics 906 (e.g., processors, amplifiers, D/A converters, A/D converters, power supplies, etc.) for processing, converting and amplifying audio content from local audio sources (e.g., audio content stored in memory within the enclosure 710, a CD connected to the audio playback device, a portable music device such as an IPod connected to the audio playback device 110', etc.).

[00150] CONTROLLERS

[00151] Referring to FIG. 10, an exemplary controller 130 includes a processor 1000, a memory 1010, a display 1012, a user input interface 1014, and a network interface 1016, among other components. The controller 130 may also be provided with a mass storage device 1018, such as a hard drive, a micro-drive, or other device, to provide additional storage. Each of the processor 1000, the memory 1010, the display 1012, and the network interface 1016 are interconnected using various buses, and several of the components may be mounted on a common motherboard or in other manners as appropriate.

[00152] The processor 1000 can execute instructions (e.g., software) within the controller 130, including instructions stored in the memory 1010 or in a secondary storage device (e.g., mass storage device 1018). The processor 1000 may be implemented as a chipset

of chips that include separate and multiple analog and digital processors. The processor 1000 may provide, for example, for coordination of other components of the controller 130, such as control of user interfaces, applications run by the controller 130, and network communication by the controller 130. The processor 1000 may communication with a user through the display 1012 and the user input interface 1014.

[00153] The processor 1000 may communicate with the user through a display interface 1020 coupled to the display 1012. The display 1012 may include an LCD monitor, or a touch sensitive display (e.g., in the case of a mobile device). The display interface 1020 may comprise appropriate circuitry for driving the display 1012 to preset graphical and other information to the user.

[00154] The user input interface 1014 may include one or more user input devices such as a keyboard, a pointer device such as a mouse, and/or a touch sensitive display. In some cases, the same device (e.g., a touch sensitive display) may be utilized to provide the functions of the display 1012 and the user input interface 1014.

[00155] The network interface 1016 facilitates wireless communication (e.g., Wi-Fi, Bluetooth, IR, etc.) with one or more of the audio playback devices (item 110, FIG. 1) via a corresponding network interface (item 720, FIG. 7C) on the audio playback device 110.

[00156] The memory 1010 stores information within the controller 130. In some implementations, the memory 1010 is a volatile memory unit or units. In some implementations, the memory 1010 is a non-volatile memory unit or units. The memory 1010 may also be another form of computer-readable medium, such as magnetic or optical disk.

[00157] The mass storage device 1018 is capable of providing mass storage for the controller 130. In some implementations, the mass storage device 1018 may be or contain a computer readable medium, such as a floppy disk device, a hard disk device, an optical disk device, or a tape device, a flash memory or other similar solid state memory device, or an array of devices.

[00158] Instructions (e.g., software) can be stored in an information carrier. The instructions, when executed by one or more processing devices (e.g., the processor 1000), perform one or more processes, such as those described above (e.g., with reference to FIGS. 2, 3, 5, 6 and 8). The instructions can also be stored by one or more storage devices such as computer- or machine-readable mediums (for example, the memory 1010, the storage device 1018, or memory in the processor 1000).

[00159] Referring to FIG. 11, the controller software can include a user application 1100, a DLNA server daemon 1110, and a USB driver 1112. The user application 1100 is run by the user and can be started from a daemon in response to a Region Icon command. The user application 1100 includes computer-executable instructions (e.g., software modules) for system account creation and management (i.e., creating and managing a user's system account) (1114); audio playback device registration and configuration (1116); network management (1118); preset/recent management (1120); transport control (e.g., play/pause, rewind/forward, etc.) for the audio playback devices (1122); initiating firmware updates for the audio playback devices (1124); music services setup (1126); and context sensitive help (1128). Each of these functions can be provided by a corresponding software module.

[00160] The DLNA server daemon 1110 serves music from the user's computer (e.g., iTunes, Windows Media Player, or files in a folder) to audio playback devices 110. The DLNA server 1110 is installed as a system service and always runs when the computer (controller 130) is booted. The DLNA server daemon 1110 shows as a tray icon when running in the background and can continue to serve music even when the user application 1100 is shut down. The DLNA server daemon 1110 can provide the user with the options for enabling and disabling the serving of the selected music library.

[00161] The USB driver 1112 defines how the audio playback device 110 communicates with the controller 130 over a local USB connection. The USB driver 1112 is installed as a device driver. In some cases, the USB driver 1112 is just an .INF file (i.e., a plain text information file) that points to a standard USB driver. The USB driver 1112 can be loaded

by the controllers 130 operating system when the audio playback device 110 is connected via USB.

[00162] FIG. 12 is a state interaction diagram that shows an overview of various user interface states of the user application 1100. Referring to FIG. 12, the user application consists of four primary user interface (UI) states: a setup state 1210; a tutorial state 1212; a main application state 1214; and a settings state 1216.

[00163] A first run of the user application 1100 initiates the setup state 1210. The setup state 1210 performs network (e.g., Wi-Fi/Ethernet) setup, system account creation, and music services setup via the corresponding software modules (FIG. 11). After a first run of the user application 1100, the Wi-Fi setup is automatically triggered when an audio playback device 110 (FIG. 1) is connected to a controller 130 (FIG. 1) via USB.

[00164] When the setup state 1210 is completed, the user is shown a pop-up 1218 that gives him/her the option to view a tutorial, or to skip it and go directly to the main application state 1214. If the user elects to view the tutorial, the tutorial state 1212 runs and provides a step-by-step overview of how to use the main application UI state. As mentioned above, the secondary network controllers 130b (FIG. 1) may not offer all of the functionality of the primary network controllers 103a (FIG. 1). More specifically, the secondary network controllers 130b may not provide the setup functions offered by the primary network controllers 130a, and, consequently, the secondary network controllers 130b may start at step 1218.

[00165] When the tutorial 1212 is complete, or if the user elects to skip the tutorial, the main application state 1214 runs. The main application state 1214 is the primary application view that the user interfaces with.

[00166] The user can access the settings state 1216 via the main application state 1214 (e.g., settings can be a menu item that is selectable from the main application state 1214. The settings state 1216 is an interface for adjusting system settings. The settings state 1216 can be used to: (i) adjust account settings (e.g., change an account password, delete

an audio system account, etc.); (ii) adjust device settings (e.g., update software, change a device name, etc.); (iii) adjust presets and recents settings (e.g., change between local and global settings); (iv) adjust music services settings (e.g., add a music service, change location for local Internet radio, edit a Pandora® account, connect another Pandora® account); and adjust stored music settings (e.g., add or remove a music library).

[00167] FIG. 13 illustrates a high-level workflow for the setup state. The setup state 1210 consists of four main steps: Adding devices (e.g., audio playback devices and auxiliary controllers) to a user's system network (1310); audio playback device software update (1312); system account creation (1314); and music setup (1316).

[00168] The setup state 1210 is generally initiated when an audio playback device 110 is connected to the controller 130 via a USB connection. This starts the step of adding devices to an audio system network LAN 150 (FIG. 1), which will begin by prompting the user to select how the USB connected audio playback device 110 will connect to the LAN (item 150, FIG. 1) (e.g., via Wi-Fi connection or via Ethernet connection) (1320). Once the user selects the network connection type, the user will be prompted to setup the network connection (1322). This can include entering network credentials (e.g., entering a network name or selecting from a list of available networks and entering a password if the network is password protected).

[00169] Once a network connection is established, the user interface on the controller 130 can prompt the user to disconnect the audio playback device 110 from the controller 130 (i.e., disconnect the USB connection) and connect the audio playback device 110 to power where the user intends to use it, and then return to complete setup.

[00170] Next, the user interface can prompt the user to pair an auxiliary controller (BTLE controller) and can walk the user through the pairing process (1324). Then, the user can be prompted to setup additional devices (1326). Additional devices can be added by connecting via USB and going through the aforementioned steps for each subsequently added device.

[00171] In the next step (1328) of the setup process, device software is updated. The controller sends a command to the network connected audio playback devices to check for software updates (the software updates may be made available through the server and/or via a separate Internet service). The controller will prompt the user to update the audio playback devices if any updates are available and sends a command to the audio playback devices for update. The controller can indicate the software update progress via the user interface and can display a popup window in case of any errors.

[00172] Once updates are completed, the controller will guide the user through creating an audio system account or will prompt the user to sign in to an existing account (1330). The system account will be created on the server via direct interaction between the controller and the server.

[00173] Next, the controller guides the user through music setup (1316) which includes setting up the user's stored music sources including PC stored music, NAS devices, etc. (1332) as well as setting up Internet based audio sources (e.g., Pandora®, vTuner®, etc.) (1334).

[00174] In some cases, when setting up the digital audio sources, the user may be prompted to enter account credentials. For example, when adding a user's Pandora® account to the user's system account, the Pandora® Internet service may request account credentials from the user. In return, Pandora® will return a unique identifier ("token") that can be stored on the server and in memory on each of the audio playback devices and which will allow the audio playback devices subsequent access to the remote audio source without requiring login each time.

[00175] FIG. 14A is a swim lane diagram showing steps for music setup for a digital audio source such as an Internet music service. Three swim lanes are shown in FIG. 14A including a lane for one of the controllers 1410, a lane for a selected one of the audio playback devices 1412, and a lane for a selected one of the digital audio sources (e.g., an Internet music service such as Pandora®) 1414.

[00176] At step 1420, the controller receives user input requesting access to an Internet music service, and, at step 1422, sends the request to a selected one of the audio playback devices.

[00177] The selected audio playback device receives the request from the controller (1424) and sends the request to the Internet music source (1426). Internet music source receives request (1428) and responds with a request for login credentials (1430).

[00178] The selected audio playback device receives the request for credentials (1432) and sends the request to the controller (1434). At step 1436, the controller receives the request for login credentials, and, at step 1438, the controller displays the request for login credentials to the user.

[00179] At step 1440, the controller receives login credentials from the user, and, at step 1442, the controller sends the login credentials to the selected audio playback device. The selected audio playback device receives the login credentials (1444) and sends the credentials to the Internet music service (1446).

[00180] At step 1448, the Internet music service receives the login credentials, and, at step 1450, authenticates the user's account. If the user's account is authenticated, the Internet music service will grant access and return a token to the selected audio playback device (1452). As discussed above, the token allows the Internet music service to identify and associate the device with a user's Internet music service account, thus obviating the need for login credentials after music services setup.

[00181] The selected audio playback device receives the token (1454), and stores the token within memory in the selected audio playback device (1456). The token can then be distributed to other devices within the audio system to allow those other devices to similarly access the Internet music service.

[00182] FIG. 14B is a swim lane diagram showing steps for for distribution of tokens for accessing account based digital audio sources such as certain Internet music services.

Three swim lanes are shown in FIG. 14B including a lane for a first one of the audio playback devices 1460, a lane for the other audio playback devices in the audio system 1462, and a lane for the remote server 1464. The first one of the audio playback devices (the first audio playback device) corresponds to the selected one of the audio playback devices that was utilized by the selected one of the controllers to setup the Internet music service as described above with respect to FIG. 14A.

[00183] At step 1466, the first audio playback device sends a copy of the token received from the Internet music service to the server. The server receives the token from the first audio playback device (1468), and stores a copy of the token locally (e.g., within memory) on the server (1470).

[00184] At step 1472, the first audio playback device sends a communication to each of the other audio playback devices (e.g., a separate notification to each of the other audio playback devices) in the audio system notifying the other playback devices that there have been changes to the user's account (i.e., a new digital audio source has been added to the audio system).

[00185] At step 1474, the other audio playback devices receive the notification from the first audio playback device. In response to receiving the notification, each of the audio playback devices sends a communication to the server requesting information corresponding to the changes to the user's account (1476).

[00186] At step 1478, the server receives the requests from the other audio playback devices. In response to the requests received from the other audio playback devices, the server responds by providing the new account information (which may consist of a copy of the token for the recently added Internet music service) to each of the other audio playback devices (1480).

[00187] At step 1482, the other playback devices receive the new account information (e.g., a copy of the token) from the server. Upon receipt of the update information, the

other playback devices update their locally stored copies of the user's account information (i.e., by adding the token to stored data) (1483).

[00188] The distribution of "tokens" can help to facilitate single press access to the sources (e.g., via the preset indicators on the audio playback devices) to provide for source agnostic operation (i.e., the audio playback devices behave the same regardless of the source). This can help to allow the preset indicators on the audio playback devices to provide access to their respectively assigned entities irrespective of the associated digital audio source.

[00189] Referring to FIG. 15A, the user interface 1500 for the main application state includes: an audio playback device region 1510, a preset region 1512, and a source region 1514. The audio playback device region 1510 lists audio playback devices 1516 on the LAN (150, FIG. 1) that are available for control. User can select the audio playback device 1516 from the list of available devices. The device that is currently selected is centered in the region. This is the device for which now playing information, presets, and recents are shown. The audio playback device region 1510 includes a volume slider 1518 which can be used to control the volume of the selected device.

[00190] The preset region provides a list of preset indicators 1520 (in the form of virtual buttons) which correspond to the preset indicators (item 718, FIG. 7B) on the selected audio playback device. The list can include a description of the corresponding entity assigned to the preset indicator along with a numerical identifier for the preset indicator. Users can select a preset (e.g., by double-clicking) play content associated with the selected preset with the selected audio playback device. Or, as discussed below, the user can use the interface to assign entities to the presets.

[00191] The source region 1514 displays one of two modes of the main application. The two modes of the main application include a "Now Playing" mode (FIG. 15A) and an "Explore" mode (FIG. 15B). In the Now Playing mode, the source region 1514 displays album art 1522 for content being played by the selected audio playback device. The source region 1514 includes an identification of the audio source 1524 for the playing

content, as well as source specific now playing information 1526 such as Artist Name/Album Name/Track name. In Now Playing mode, the source region 1514 also includes source specific buttons 1528, which may include transport functions such as play, pause, skip forward, etc. Also displays an "Explore" button 1530 which allows the user to navigate to the Explore mode.

[00192] Referring to FIG. 15B, the Explore mode allows the user to browse available content and features. In the Explore mode, the source region 1514 displays one of a plurality of lists that the user can navigate through to select content to play, to select an entity to assign to a preset, to access Help content, and/or to manage settings.

[00193] A top-level Explore list (FIG. 15B) will include links 1532 to: digital audio sources (e.g., global and/or local Internet radio provided by vTuner®, stored music, Pandora®, etc.), recents list, help content, and the settings UI state. Audio sources with multiple accounts (e.g., multiple Pandora® accounts all associated with the user's system account) may be listed by date, with the first one set up listed first.

[00194] Selection of an audio source opens a sub-list of entities (FIG. 15C, showing sub-list of entities) associated with the selected source (the "Global Internet Radio" source (e.g., provided by vTuner®)) in the source region 1514. The sub-list of entities is generated via communication between the controller, the selected audio playback device, and the selected audio source as discussed above. A "Now Playing" button 1534 allows the user to navigate to the Now Playing mode.

[00195] FIGS. 16A through 16C illustrate another implementation of a graphical user interface 1600 for the main application that may be utilized for mobile devices. In the implementation of FIGS. 16A-16C, the main application can be in one of three modes: Presets mode (FIG. 16A), Now Playing mode (FIG. 16B), or Explore mode (FIG. 16C). The user can navigate between Presets, Now Playing, and Explore modes by swiping/navigating left/right amongst these modes.

[00196] Referring to FIG. 16A, the user interface 1600 for the main application includes: an audio playback device region 1612, a presets region 1614, and a source region 1616. The audio playback device region 1612 lists audio playback devices on the LAN (item 150, FIG. 1) that are available for control. User can select the audio playback device from the list of available devices. The Audio playback device region 1612 includes a volume slider 1616 which can be used to control the volume of the selected device.

[00197] The presets region 1614 includes a list of preset indicators 1620 (in the form of virtual buttons) which correspond to the preset indicators on the selected audio playback device. The preset indicators (item 718, FIG. 7B) are identified by corresponding numerical identifiers for each preset indicator. Users can select a preset (e.g., by double-clicking) play content associated with the selected preset with the selected audio playback device.

[00198] The source region 1616 displays the Presets mode, the Now Playing mode, or the Explore mode of the main application. In the Preset mode, shown FIG. 16A, the source region 1616 displays additional information for the device presets. The additional information can include a description of the corresponding entity assigned to the preset along with a numerical identifier for the preset button.

[00199] In the Now Playing mode (FIG. 16B), the source region 1616 displays album art 1618 for content being played by the selected audio playback device. The source region 1616 also includes an identification of the audio source 1620 for the playing content, as well as source specific now playing information 1622 such as Artist Name/Album Name/Track name. In the Now Playing mode, the source region 1616 also includes source specific buttons 1624, which may include transport functions such as play, pause, skip forward, etc.

[00200] The Explore mode (FIG. 16C) allows the user to browse available content and features. In the Explore mode, the source window displays one of a plurality of menus that the user can navigate through to select content to play, to select an entity to assign to a preset, to access Help content, and/or to manage settings.

[00201] A top-level Explore list will include links to: available audio sources, recents, help content, and the settings UI state. Audio sources with multiple accounts (e.g., multiple Pandora® accounts all associated with the user's system account) may be listed by date, with the first one set up listed first.

[00202] Selection of an audio source opens a sub-list of entities associated with the selected source in the source window. The sub-list of entities is generated via communication between the controller, the selected audio playback device, and the selected audio source as discussed above.

[00203] FIG. 17 illustrates a process 1700 for setting preset from a controller. The process 1700 includes selecting an audio playback device from the audio playback device region of the user interface (1710). The selected audio playback device will be the device that the controller utilizes to communicate with the digital audio sources. The process 1700 also includes assigning an entity to a preset indicator on the selected audio playback device (1712).

[00204] In this regard, preset assignments can be set from either the "Now Playing" mode or the "Explore" mode of the main application. Assigning from the Now Playing mode will assign entity associated with currently playing content to the selected preset.

[00205] FIGS. 18A and 18B show a sequence of screen displays illustrating the setting of a preset assignment from the Now Playing mode on a desktop or laptop computer. Referring to FIGS. 18A and 18B, the user selects (e.g., by clicking with pointing device (mouse) or tapping in the case of a touch sensitive screen) and holds one of the preset indicators 1800 to cause the preset indicator to be highlighted (FIG. 18A). After the selected preset indicator 1800 is held for a predetermined amount of time, the preset indicator 1800 will be assigned to the "Now Playing" entity. This may be indicated by a change in the text associated with the preset indicator 1800 (e.g., the text may be updated to reflect the newly associated entity's name, as shown in FIG. 18B). The new or updated preset assignment will take effect on the selected audio playback device 1810 (i.e., the device selected in the audio playback region) which is being controlled by the controller.

[00206] Alternatively, as illustrated in FIGS. 19A and 19B, the user can right-click on one the preset indicators 1900 and select “Set Preset” from a right-click menu 1910 to assign the entity associated with the currently playing content to be assigned to the selected preset indicator 1900.

[00207] Alternatively, Referring to FIGS. 20A and 20B, the main application state may include a menu bar 2000 with a “Set Preset” button 2010. The user can set a preset assignment by clicking on the “Set Preset” button 2010 to display a Preset menu 2012. The user can choose a preset from the preset menu 2012 to assign the entity (e.g., Internet radio station) associated with the “Now Playing” content to. Preset changes may be indicated by text changes to the station name associated with the preset indicator (FIG. 18B).

[00208] FIGS. 21A through 21C illustrate yet another method of setting a preset from the “Now Playing” mode. The user can click/tap 2100 and hold within the source region (FIG. 19A). The entity to be assigned to a preset appears in a pop-up 2110 in the clicked/tapped area (FIG. 19B). And the entity is dragged and dropped on the destination preset indicator 2112 (FIG. 19C).

[00209] FIGS. 22A and 22B illustrate a method of assigning a preset in the Browse mode. The user selects an entity 2200 from a list of entities 2210 and drags the selected entity to the preset indicator 2212 (FIG. 20A). The preset assignment is updated to reflect the change. This can be reflected by a text update on the preset indicator 2212 (FIG. 20B).

[00210] Alternatively, the preset assignment can be set or changed on the audio playback device itself by pressing and holding one of the preset indicators on the device’s enclosure. This will assign an entity associated with currently plating content to the selected preset indicator.

[00211] Once a preset assignment is set for the first time or changed on one of the audio playback devices, the preset assignments can be synchronized across the audio system as described above with respect to FIG. 2.

[00212] SERVER

[00213] FIG. 23 illustrates an exemplary computing device 2300 that can be utilized to implement the server (item 140, FIG. 1). The computing device 2300 is intended to represent various forms of digital computers, such as servers, blade servers, mainframes, and other appropriate computers. The components shown here, their connections and relationships, and their functions, are meant to be examples only, and are not meant to be limiting.

[00214] The computing device 2300 includes a processor 2310, a memory 2312, a storage device 2314, a high-speed interface 2316 connecting to the memory 2312 and multiple high-speed expansion ports 2318, and a low-speed interface 2320 connecting to a low-speed expansion port 2322 and the storage device 2314. Each of the processor 2310, the memory 2312, the storage device 2314, the high-speed interface 2316, the high-speed expansion ports 2318, and the low-speed interface 2320 are interconnected using various busses, and may be mounted on a common motherboard or in other manners as appropriate. The processor 2310 can process instructions (e.g., a software program) for execution within the computing device 2300, including instructions stored in the memory 2312 or on the storage device 2314 to display graphical information for a GUI on an external input/output device, such as a display 2324 coupled to the high-speed interface 2316. In other implementations, multiple processors and/or multiple buses may be used, as appropriate, along with multiple memories and types of memory. Also, multiple computing devices may be connected, with each device providing portions of the necessary operations (e.g., as a server bank, a group of blade servers, or a multi-processor system).

[00215] The memory 2312 stores information within the computing device 2300. In some implementations, the memory 2312 is a volatile memory unit or units. In some implementations, the memory 2312 is a non-volatile memory unit or units. The memory 2312 may also be another form of computer-readable medium, such as a magnetic or optical disk.

[00216] The storage device 2314 is capable of providing mass storage for the computing device 2300. In some implementations, the storage device 2314 may be or contain a computer-readable medium, such as a floppy disk device, a hard disk device, an optical disk device, or a tape device, a flash memory or other similar solid state memory device, or an array of devices, including devices in a storage area network or other configurations. Instructions can be stored in an information carrier. The instructions, when executed by one or more processing devices (for example, processor 2310), perform one or more processes, such as those described above (e.g., with reference to FIGS. 2, 3, 5, 6, 14B). The instructions can also be stored by one or more storage devices such as computer- readable mediums (for example, the memory 2312, the storage device 2314, or memory on the processor 2310). The storage device 2314 may provide storage for a database 2324. The database can be used to store audio system account information.

[00217] The high-speed interface 2316 manages bandwidth-intensive operations for the computing device 2300, while the low-speed interface 2320 manages lower bandwidth-intensive operations. Such allocation of functions is an example only. In some implementations, the high-speed interface 2316 is coupled to the memory 2312, the display 2322 (e.g., through a graphics processor or accelerator), and to the high-speed expansion ports 2318, which may accept various expansion cards (not shown). In the implementation, the low-speed interface 2320 is coupled to the storage device 2314 and the low-speed expansion port 2322. The low-speed expansion port 2322, which may include various communication ports (e.g., USB, Bluetooth, Ethernet, wireless Ethernet) may be coupled to one or more input/output devices, such as a keyboard, a pointing device, a scanner, or a networking device such as a switch or router, e.g., through a network adapter.

[00218] The computing device 2300 may be implemented in a number of different forms, as shown in the figure. For example, it may be implemented as a standard server 2330, or multiple times in a group of such servers 2332. It may also be implemented as part of a rack server system.

[00219] Implementations of the systems and methods described above comprise computer components and computer-implemented steps that will be apparent to those skilled in the art. For example, it should be understood by one of skill in the art that the computer-implemented steps may be stored as computer-executable instructions on a computer-readable medium such as, for example, floppy disks, hard disks, optical disks, Flash ROMS, nonvolatile ROM, and RAM. Furthermore, it should be understood by one of skill in the art that the computer-executable instructions may be executed on a variety of processors such as, for example, microprocessors, digital signal processors, gate arrays, etc. In addition, the instructions may be implemented in a high-level procedural and/or object-oriented programming language, and/or in assembly/machine language. For ease of exposition, not every step or element of the systems and methods described above is described herein as part of a computer system, but those skilled in the art will recognize that each step or element may have a corresponding computer system or software component. Such computer system and/or software components are therefore enabled by describing their corresponding steps or elements (that is, their functionality), and are within the scope of the disclosure.

[00220] A number of implementations have been described. Nevertheless, it will be understood that additional modifications may be made without departing from the scope of the inventive concepts described herein, and, accordingly, other implementations are within the scope of the following claims.

What is claimed is:

1. A method for managing presets in an audio system, the method comprising:

syncing preset assignments on a plurality of audio playback devices such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices, and, such that, if one of the preset assignments is changed on one of the audio playback devices, each of the other audio playback devices is automatically updated such that a corresponding change is made to a corresponding preset assignment on each of the other audio playback devices,

wherein each of the preset assignments is an assignment of an entity associated with one of a plurality of digital audio sources to one of a plurality of preset indicators on the corresponding one of the audio playback devices.

2. The method of claim 1, wherein the step of syncing preset assignments on a plurality of audio playback devices comprises:

receiving information from a first audio playback device of the audio system regarding a change to one or more of a plurality of preset assignments;

updating stored preset data based on the information received from the first audio playback device; and

providing update information to one or more other audio playback devices of the audio system such that the one or more other audio playback devices update their respective preset assignments to correspond to those of the first audio playback device.

3. The method of claim 2, wherein the step of updating stored preset data comprises updating preset data stored on a remote server.

4. The method of claim 2, wherein the step of updating stored preset data comprises replacing a first set of preset assignments with a second, updated set of preset assignments.

5. The method of claim 1, further comprising receiving user input regarding the assignment of an entity associated with one of the digital audio sources to one of the preset indicators on a first one of the audio playback devices.

6. The method of claim 5, wherein the user input corresponds to actuation of a hardware button on a first one of the audio playback devices.

7. The method of claim 5, wherein the user input is received via a controller connected to the first one of the audio playback devices via a network connection.

8. The method of claim 1, wherein the assignable entities include at least (i) user-defined playlists of digital music and (ii) Internet radio stations.

9. The method of claim 1, wherein the digital audio sources include a plurality of Internet radio sites, and the entities include individual radio stations provided by the Internet radio sites.

10. The method of claim 1, wherein the preset indicators provide access to their respectively assigned entities in the same manner irrespective of the associated digital audio source.

11. The method of claim 10, wherein the preset indicators provide for single press access to the respectively assigned entities, irrespective of the digital audio source.

12. An audio system server comprising:

a processor; and

instructions stored on a computer-readable media that, when executed, cause the processor to:

receive information from a first audio playback device of an audio system regarding a change to one or more of a plurality of preset assignments, each of the preset

assignments representing an assignment of an entity associated with one of a plurality of digital audio sources to a corresponding preset indicator;

update stored preset data based on the information received from the first device; and to

provide update information to one or more other audio playback devices of the audio system such that each of the one or more other audio playback devices update their respective preset assignments to correspond to those of the first audio playback device.

13. The audio system server of claim 12, wherein the audio system server is a cloud-based server.

14. The audio system server of claim 12, wherein the instructions, when executed, cause the processor to provide the update information to the one or more other audio playback devices in response to communication received from the one or more other audio playback devices requesting the update information.

15. The audio system server of claim 12, wherein the update information is an updated list of preset assignments.

16. The audio system server of claim 12, wherein the instructions, when executed, cause the processor to:

maintain a global recents list, wherein the global recents list is a list of entities that is populated from content that the user has chosen to play on one or more of the audio playback devices.

17. The audio system server of claim 16, wherein the instructions, when executed, cause the processor to:

receive information from a first audio playback device of an audio system regarding selection of a first entity for providing streamed music;

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update stored recent data based on the information received from the first device; and to

provide updated recents information to one or more other audio playback devices of the audio system such that each of the one or more other audio playback devices updates a locally stored recents list to correspond to a recents list stored on the first audio playback device.

18. The audio system server of claim 12, wherein the instructions, when executed, cause the processor to:

receive a copy of a token from a first audio playback device of an audio system, wherein the token is a unique identifier that a corresponding one of the digital audio sources recognizes and associates with a user account, thereby to provide access to the user account;

store the copy of the token within the audio system server; and to

provide copies of the token other audio playback devices of the audio system such that the corresponding one of the digital audio sources can recognize the other audio playback devices as being associated with the user account.

19. An audio system comprising:

i) a plurality of audio playback devices, each audio playback device being configured to operatively connect to a plurality of digital audio sources for playback of content from the digital audio sources and each of the audio playback devices comprising:

a set of preset indicators, wherein each preset indicator in the set of preset indicators is configured to have assigned to it an entity associated with one of the plurality of digital audio sources; and

ii) a remote server configured to:

receive information from one of the audio playback devices regarding changes to preset assignments, each of the preset assignments representing an assignment of an entity associated with one of the digital audio sources to a corresponding one of the preset indicators;

update a stored set of global preset assignments based on the information received; and to

distribute update information to the other ones of the audio playback devices regarding changes to the global preset assignments,

wherein the other ones of the audio playback devices are configured to update their respective preset assignments based on the update information distributed from the remote server such that, following the update, all of the audio playback devices of the plurality of audio playback devices have the same preset assignments.

20. The audio system of claim 19, wherein the information received from the one of the audio playback devices is an updated set of global preset assignments.

21. The audio system of claim 19, wherein the remote server is configured to update the stored set of global preset assignments by replacing the stored set of global preset assignments with the updated set of global preset assignments.

22. The audio system of claim 19, wherein the remote server is configured to distribute the update information to the other ones of the audio playback devices in response to requests for update information received from the other ones of the audio playback devices.

23. The audio system of claim 19, wherein the assignable entities include at least individual Internet radio stations and particular user-defined playlists of digital music files.

24. The audio system of claim 19, wherein the set of preset indicators comprise hardware buttons.

25. The audio system of claim 19, wherein the preset indicators include numerical identifiers.

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26. The audio system of claim 19, wherein the digital audio sources include a plurality of Internet radio sites, and the entities include individual radio stations provided by the Internet radio sites.

27. The audio system of claim 19, wherein the preset indicators provide access to their respectively assigned entities in the same manner irrespective of the associated digital audio source.

28. The audio system of claim 19, wherein the preset indicators provide for single press access to the respectively assigned entities, irrespective of the digital audio source.

29. An audio playback device configured to operably connect to a plurality of digital audio sources, the audio playback device comprising:

a digital-to-analog converter configured to receive a digital representation of content from the digital audio sources and convert to analog form;

an electro-acoustic transducer;

a set of user-selectable preset indicators, wherein each indicator in the set of preset indicators is configured to have assigned to it an entity associated with the plurality of digital audio sources;

a processor; and

instructions stored on a computer-readable media that, when executed, cause the processor to:

update one or more preset assignments based on user input, each of the preset assignments representing an assignment of an entity associated with one of the digital audio sources to a corresponding one of the preset indicators; and to

send information regarding the update to the one or more preset assignments to a remote server.

30. The audio playback device of claim 29, further comprising an enclosure, wherein the digital-to-analog converter and the electro-acoustic transducer are located within the enclosure and the set of user-selectable present indicators is located on the enclosure.

31. The audio playback device of claim 29, wherein the digital audio sources comprise at least (i) one or more libraries of user-defined playlists of digital music files and (ii) Internet radio sites.

32. The audio playback device of claim 31, wherein the assignable entities include at least individual Internet radio stations and particular user-defined playlists of digital music files.

33. The audio playback device of claim 29, wherein the set of preset indicators comprise hardware buttons.

34. The audio playback device of claim 29, wherein the preset indicators include numerical identifiers.

35. The audio playback device of claim 29, wherein the digital audio sources include a plurality of Internet radio sites, and the entities include individual radio stations provided by the Internet radio sites.

36. The audio playback device of cl aim 29, wherein the preset indicators provide access to the respectively assigned entities in the same manner irrespective of the associated digital audio source.

37. The audio playback device of claim 36, wherein the preset indicators provide for single press access to the respectively assigned entities irrespective of the digital audio source.

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38. The audio playback device of claim 29, wherein the instructions, when executed, cause the processor to:

notify one or more other audio playback devices within an audio system regarding the update to the one or more preset assignments.

39. The audio playback device of claim 29, wherein the instructions, when executed, cause the processor to:

receive notification from an other audio playback device within an audio system regarding changes to preset assignments on the other audio playback device;

and, in response to receiving the notification regarding changes to the preset assignments on the other audio playback device, to contact a remote server for the audio system to request update information; and to

update one or more preset assignments on the audio playback device based on the update information received from the remote server such that preset assignments on the audio playback devices correspond to respective preset assignments on the other audio playback device.

40. An audio playback device configured to operably connect to a plurality of digital audio sources, the audio playback device comprising:

a digital-to-analog converter configured to receive a digital representation of content from the digital audio sources and convert to analog form;

an electro-acoustic transducer;

a set of user-selectable preset indicators, wherein each indicator in the set of preset indicators is configured to have assigned to it an entity associated with the plurality of digital audio sources; and

a processor; and

instructions stored on a computer-readable media that, when executed,

cause the processor to:

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update one or more preset assignments based on user input, each of the preset assignments representing an assignment of an entity associated with one of the digital audio sources to a corresponding one of the preset indicators; and to

notify one or more other audio playback devices within an audio system regarding the update to the one or more preset assignments.

41. The audio playback device of claim 40, further comprising an enclosure, wherein the digital-to-analog converter and the electro-acoustic transducer are located within the enclosure and the set of user-selectable present indicators is located on the enclosure.

42. The audio playback device of claim 40, wherein the digital audio sources comprise at least (i) one or more libraries of user-defined playlists of digital music files and (ii) Internet radio sites.

43. The audio playback device of claim 40, wherein the assignable entities include at least individual Internet radio stations and particular user-defined playlists of digital music files.

44. The audio playback device of claim 40, wherein the set of preset indicators comprise hardware buttons.

45. The audio playback device of claim 40, wherein the preset indicators include numerical identifiers.

46. The audio playback device of claim 40, wherein the digital audio sources include a plurality of Internet radio sites, and the entities include individual radio stations provided by the Internet radio sites.

47. The audio playback device of claim 40, wherein the preset indicators provide access to the respectively assigned entities in the same manner irrespective of the associated digital audio source.

48. The audio playback device of claim 47, wherein the preset indicators provide for single press access to the respectively assigned entities irrespective of the digital audio source.

49. The audio playback device of claim 40, wherein the instructions, when executed, cause the processor to:

receive notification from an other audio playback device within an audio system regarding changes to preset assignments on the other audio playback device;

and, in response to receiving the notification regarding changes to the preset assignments on the other audio playback device, to contact a remote server for the audio system to request update information; and to

update one or more preset assignments on the audio playback device based on the update information received from the remote server such that preset assignments on the audio playback devices correspond to respective preset assignments on the other audio playback device.

50. An audio playback device configured to operably connect to a plurality of digital audio sources, the audio playback device comprising:

a digital-to-analog converter configured to receive a digital representation of content from the digital audio sources and convert to analog form;

an electro-acoustic transducer;

a set of user-selectable preset indicators, wherein each indicator in the set of preset indicators is configured to have assigned to it an entity associated with the plurality of digital audio sources;

a processor; and

instructions stored on a computer-readable media that, when executed, cause the processor to:

receive notification from an other audio playback device within an audio system regarding changes to preset assignments on the other audio playback device;

and, in response to receiving the notification regarding changes to the preset assignments on the other audio playback device, to contact a remote server for the audio system to request update information; and to

update one or more preset assignments on the audio playback device based on the update information received from the remote server such that preset assignments on the audio playback devices correspond to respective preset assignments on the other audio playback device, each of the preset assignments representing an assignment of an entity associated with one of the digital music sources to a corresponding one of the preset indicators.

51. The audio playback device of claim 50, further comprising an enclosure, wherein the digital-to-analog converter and the electro-acoustic transducer are located within the enclosure and the set of user-selectable present indicators is located on the enclosure.

52. The audio playback device of claim 50, wherein the digital audio sources comprising at least (i) one or more libraries of user-defined playlists of digital music files and (ii) Internet radio sites.

53. The audio playback device of claim 50, wherein the assignable entities include at least individual Internet radio stations and particular user-defined playlists of digital music files.

54. The audio playback device of claim 50, wherein the set of preset indicators comprise hardware buttons.

55. The audio playback device of claim 50, wherein the preset indicators include numerical identifiers.

56. The audio playback device of claim 50, wherein the digital audio sources include a plurality of Internet radio sites, and the entities include individual radio stations provided by the Internet radio sites.

57. The audio playback device of claim 50, wherein the preset indicators provide access to the respectively assigned entities in the same manner irrespective of the associated digital audio source.

58. The audio playback device of claim 57, wherein the preset indicators provide for single press access to the respectively assigned entities irrespective of the digital audio source.

59. An audio system comprising:

i) a plurality of audio playback devices, each audio playback device being configured to operatively connect to a plurality of digital audio sources for playback of content from the digital audio sources and each of the audio playback devices comprising:

a set of preset indicators, wherein each preset indicator in the set of preset indicators is configured to have assigned to it an entity associated with one of the plurality of digital audio sources; and

ii) a software program configured to run on a separate device, wherein the software program provides a user interface configured to present an audio playback device selection region that enables user to select one of the audio playback devices to control with the separate computer,

wherein the user interface is further configured to present a set of preset indicators that corresponds to the set of preset indicators of the selected one of the audio playback devices, and to

present a source selection region that enables a user to select an entity to assign to one of the preset indicators of the selected one of the audio playback devices.

60. The audio system of claim 59, wherein the source selection region also enables a user to select an entity to provide audio content to the selected one of the audio playback devices for playback of the audio content.

61. The audio system of claim 59, wherein the user interface is further configured to present a global recents list, wherein the global recents list is a list of entities that is populated from audio content that the user has chosen to play on one or more of the audio playback devices.

62. The audio system of claim 59, wherein the software program includes instructions to procure the global recents list from data stored on the selected one of the audio playback devices.

63. The audio system of claim 59, wherein the user interface is further configured to enable a user to select whether the preset assignments are to be global or local,

wherein global preset assignments are synchronized across the plurality of audio playback devices such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices, and, such that, if one of the preset assignments is changed on one of the audio playback devices, each of the other audio playback devices is updated such that a corresponding change is made to a corresponding preset assignment on each of the other audio playback devices, and

wherein local preset assignments are device-specific such that each of the audio playback devices can have a unique set of preset assignments and such that the preset assignments on any one of the audio playback devices do not necessarily correspond to the preset assignments on any of the other audio playback devices.

64. A computer-implemented method comprising:

storing a set of local preset assignments for each of a plurality of audio playback devices of an audio system, wherein the local preset assignments are device-specific such that the local preset assignments for any one of the audio playback devices do not necessarily correspond to the local preset assignments for any of the other audio playback devices;

receiving input regarding a change from a local setting to a global setting;

receiving input regarding selection of one of the audio playback devices to serve as a master audio playback device;

setting the set of stored local preset assignments associated with the selected, master audio playback device as a set of global preset assignments; and

providing the global preset assignments to the other playback devices of the audio system so as to synchronize the preset assignments across the audio system, such that preset assignments on any one of the audio playback devices correspond to respective preset assignments on each of the other audio playback devices.

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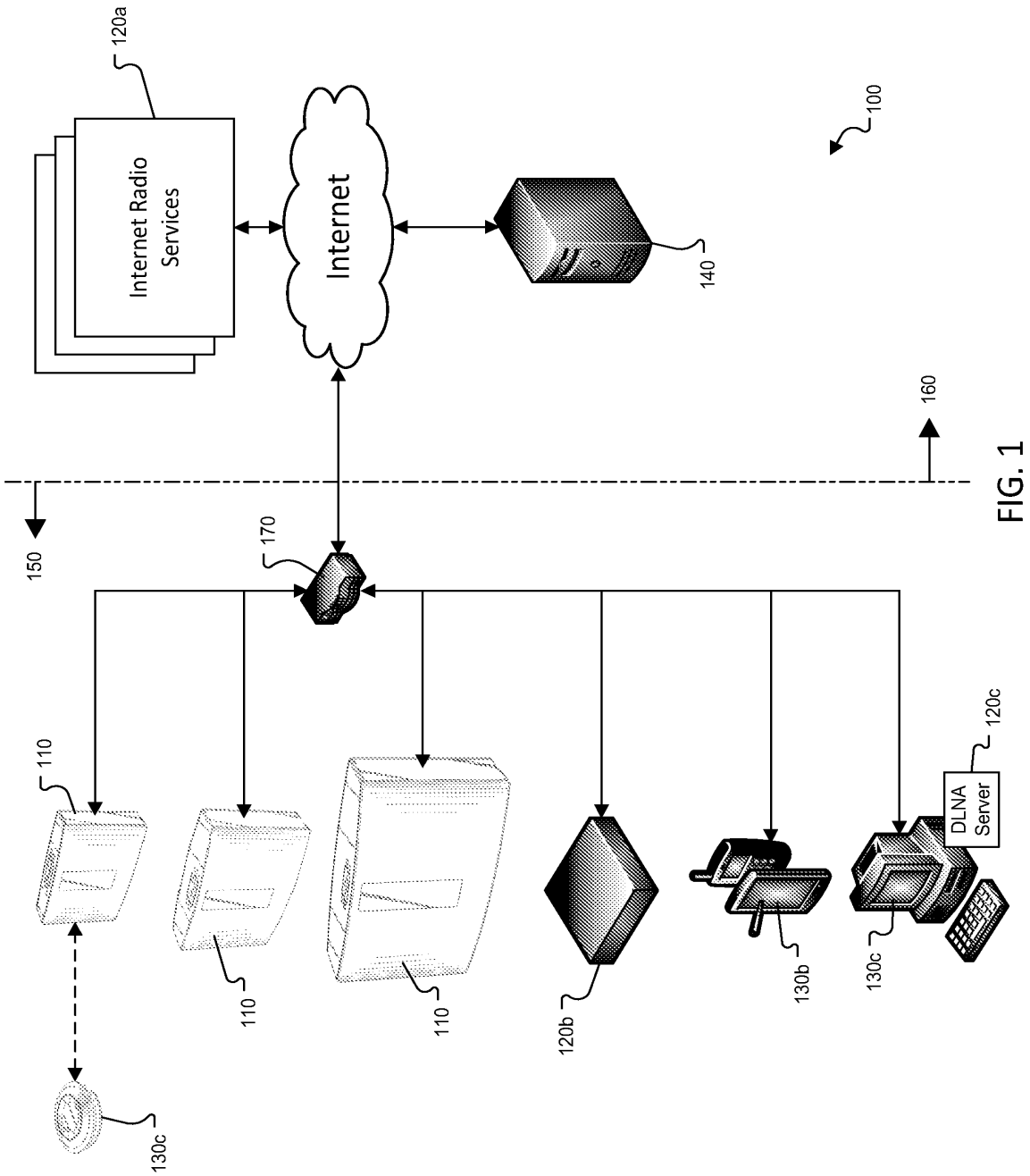

120a
Internet Radio Services
Internet
100
140
160
150
170
110
110
110
120b
130b
120c
DLNA Server
130c
130c

FIG. 1

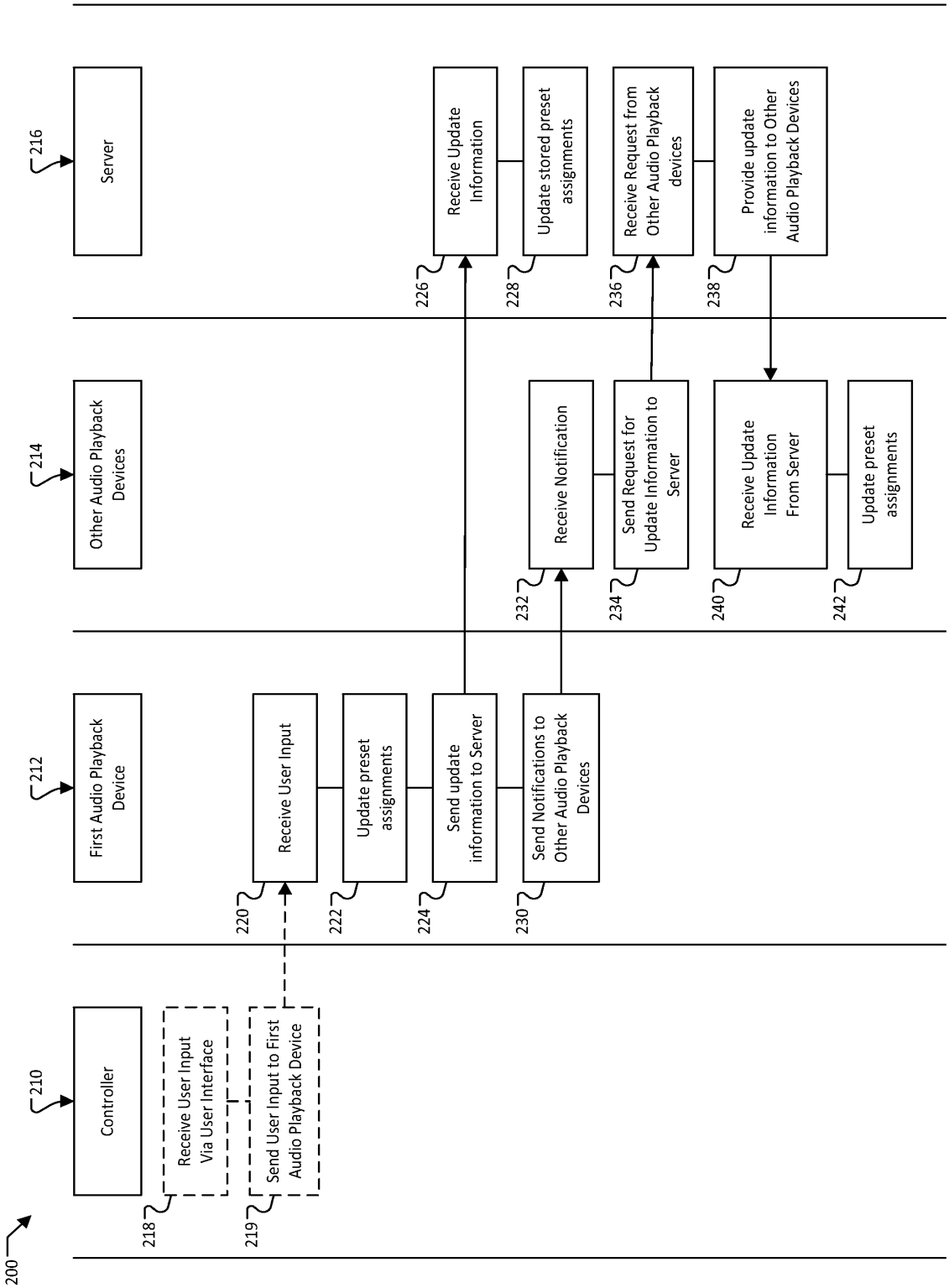

200
210
Controller
218
Receive User Input Via User Interface
219
Send User Input to First Audio Playback Device
212
First Audio Playback Device
220
Receive User Input
222
Update preset assignments
224
Send update information to Server
230
Send Notifications to Other Audio Playback Devices
214
Other Audio Playback Devices
232
Receive Notification
234
Send Request for Update Information to Server
240
Receive Update Information From Server
242
Update preset assignments
216
Server
226
Receive Update Information
228
Update stored preset assignments
236
Receive Request from Other Audio Playback devices
238
Provide update information to Other Audio Playback Devices

FIG. 2

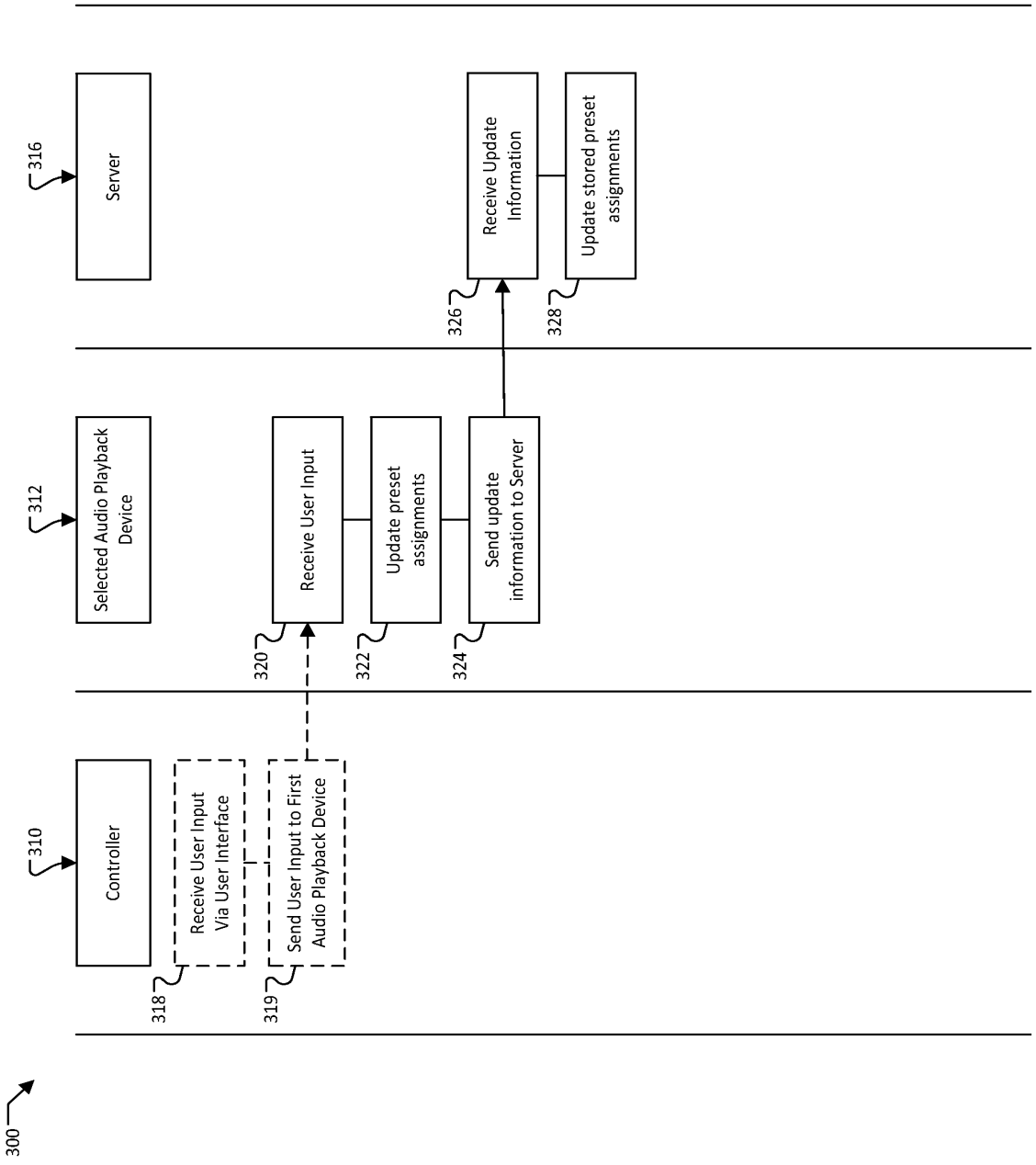

300
310
Controller
312
Selected Audio Playback Device
316
Server
318
Receive User Input Via User Interface
319
Send User Input to First Audio Playback Device
320
Receive User Input
322
Update preset assignments
324
Send update information to Server
326
Receive Update Information
328
Update stored preset assignments

FIG. 3

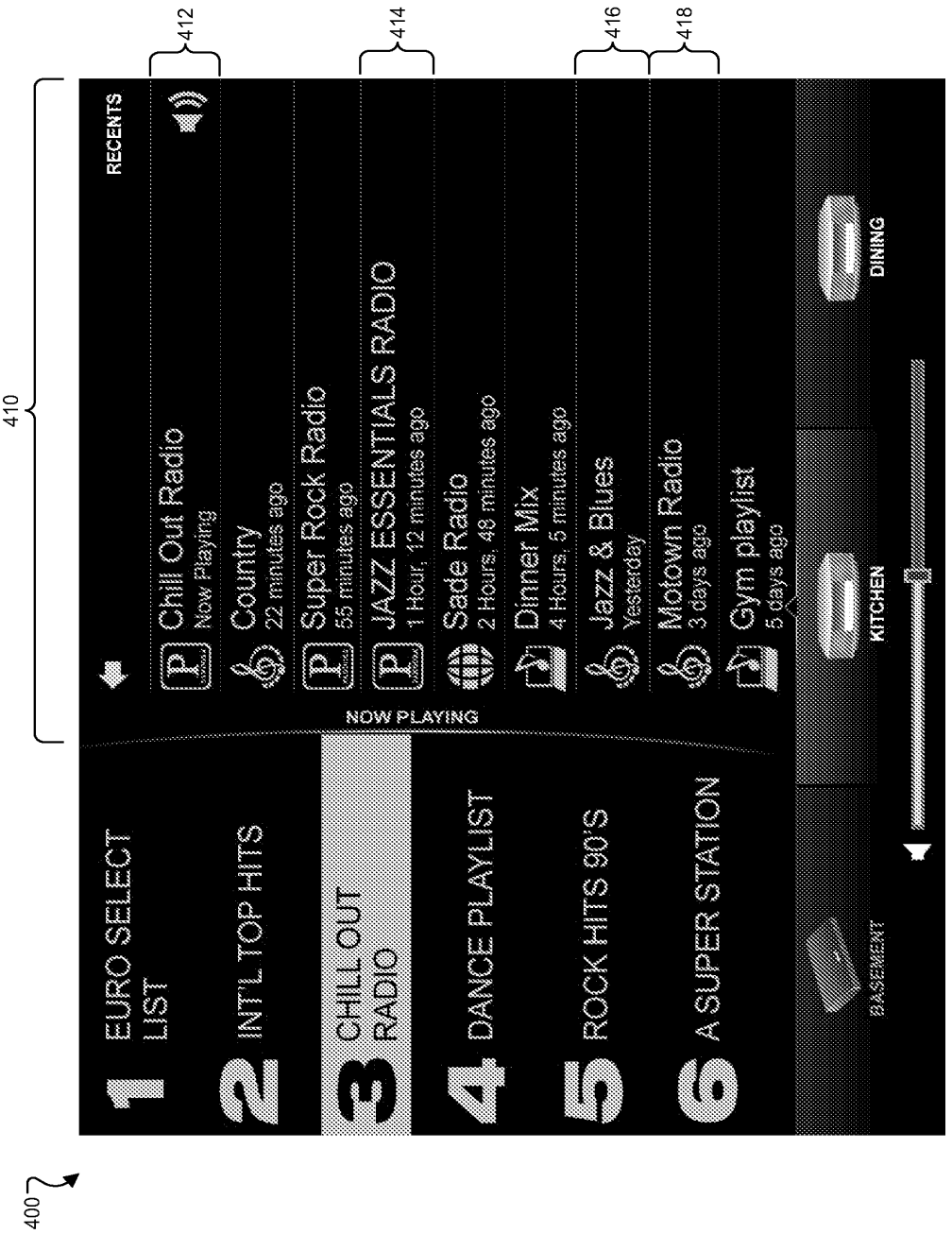

400
410
412
414
416
418
RECENTS
Chill Out Radio
Now Playing
Country
22 minutes ago
Super Rock Radio
55 minutes ago
JAZZ ESSENTIALS RADIO
1 Hour, 12 minutes ago
Sade Radio
2 Hours, 48 minutes ago
Dinner Mix
4 Hours, 5 minutes ago
Jazz & Blues
Yesterday
Motown Radio
3 days ago
Gym playlist
5 days ago
NOW PLAYING
1 EURO SELECT LIST
2 INT'L TOP HITS
3 CHILL OUT RADIO
4 DANCE PLAYLIST
5 ROCK HITS 90'S
6 A SUPER STATION
DINING
KITCHEN
BASEMENT

FIG. 4

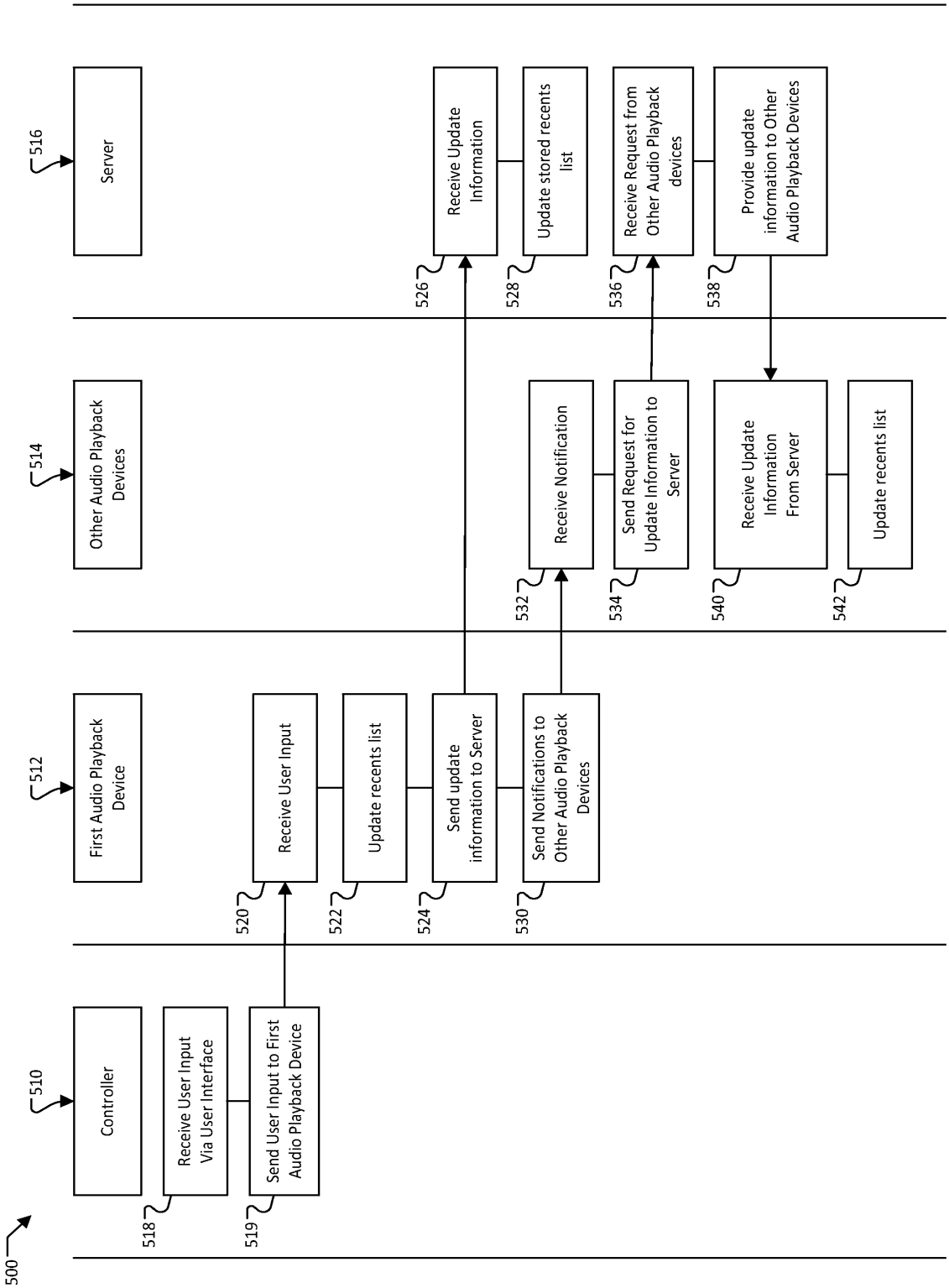

500
510
Controller
518
Receive User Input Via User Interface
519
Send User Input to First Audio Playback Device
512
First Audio Playback Device
520
Receive User Input
522
Update recents list
524
Send update information to Server
530
Send Notifications to Other Audio Playback Devices
514
Other Audio Playback Devices
532
Receive Notification
534
Send Request for Update Information to Server
540
Receive Update Information From Server
542
Update recents list
516
Server
526
Receive Update Information
528
Update stored recents list
536
Receive Request from Other Audio Playback devices
538
Provide update information to Other Audio Playback Devices

FIG. 5

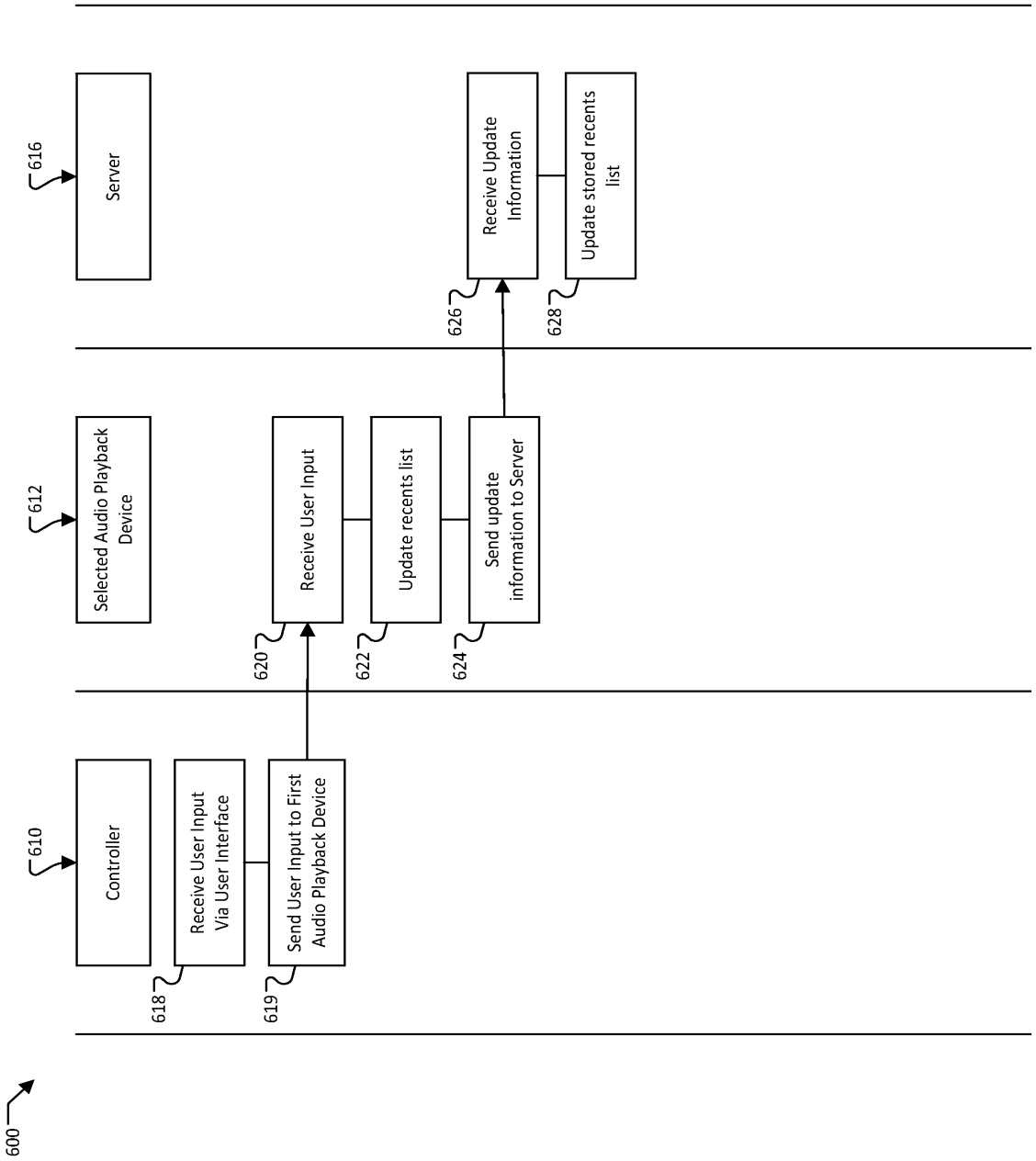

600
610
Controller
618
Receive User Input Via User Interface
619
Send User Input to First Audio Playback Device
612
Selected Audio Playback Device
620
Receive User Input
622
Update recents list
624
Send update information to Server
616
Server
626
Receive Update Information
628
Update stored recents list

FIG. 6

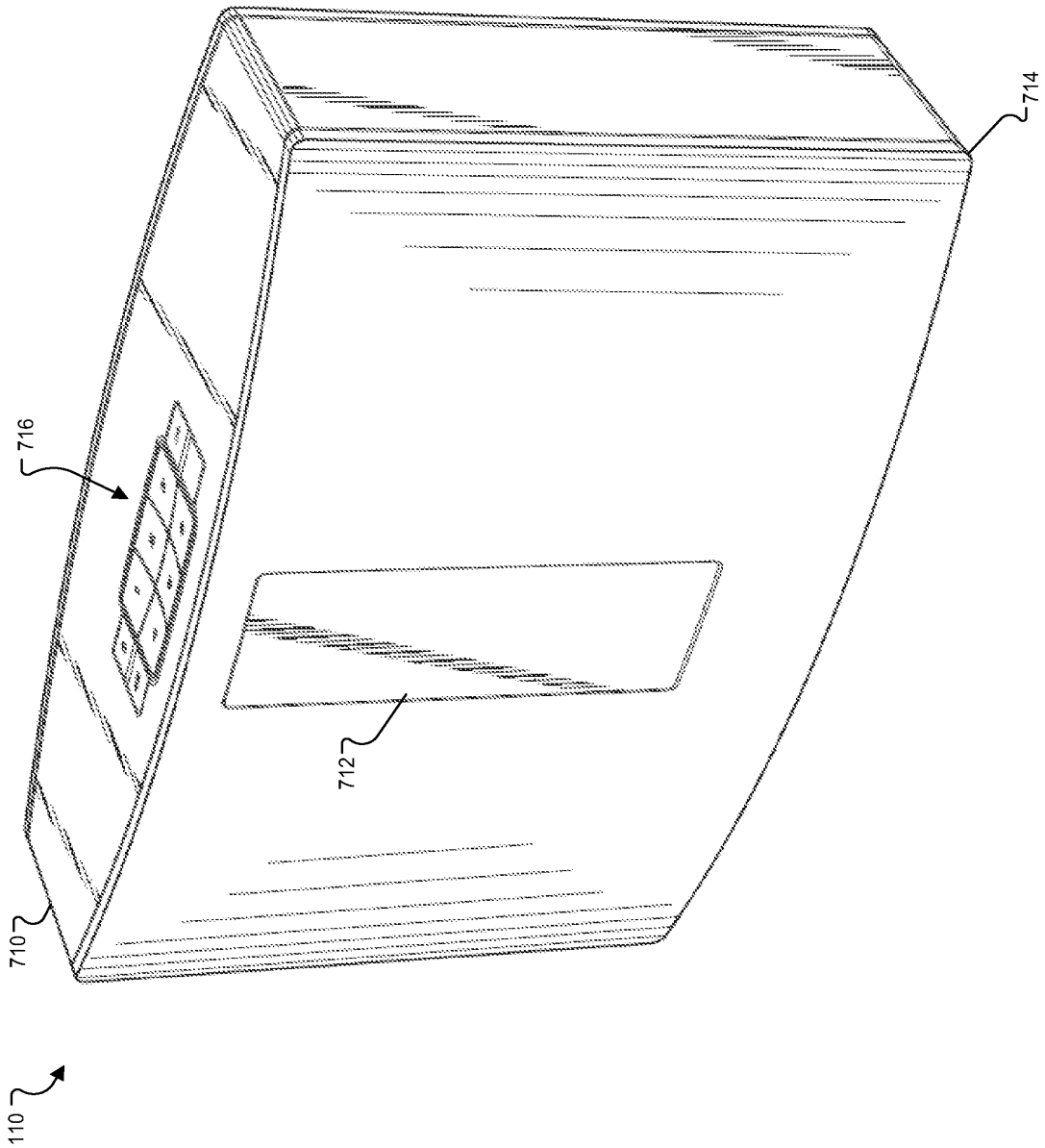


FIG. 7A

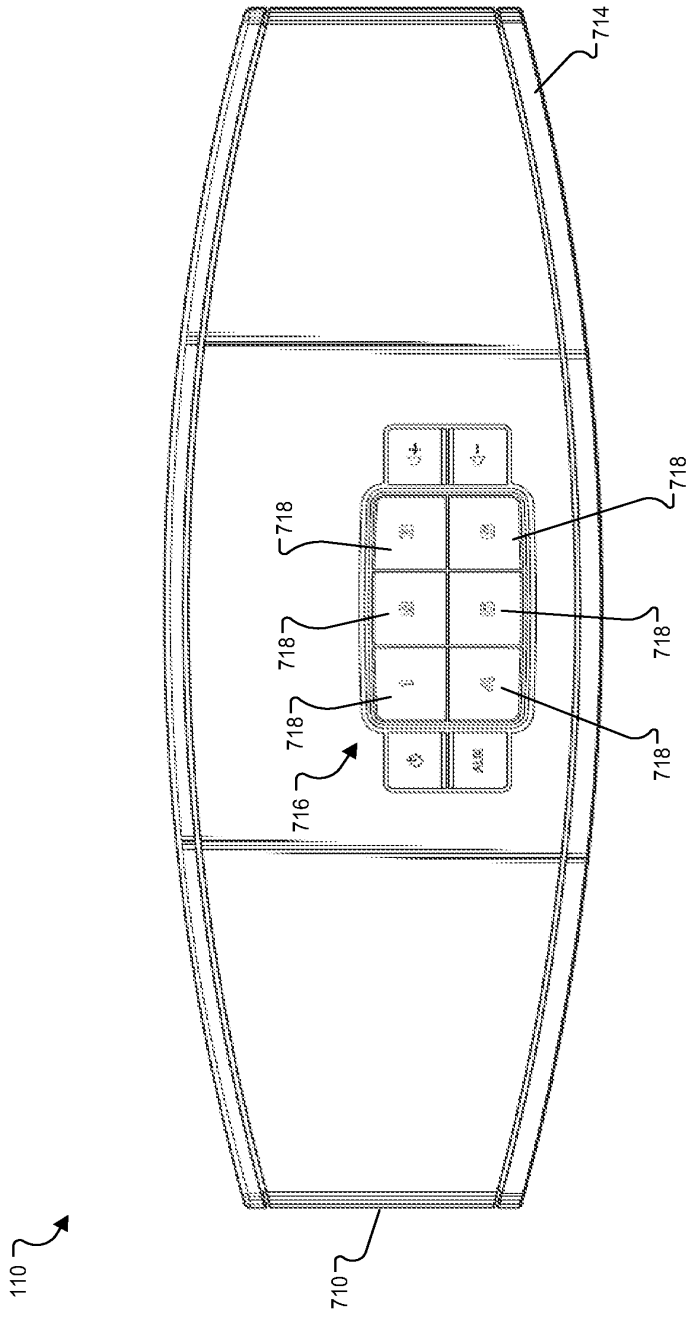


FIG. 7B

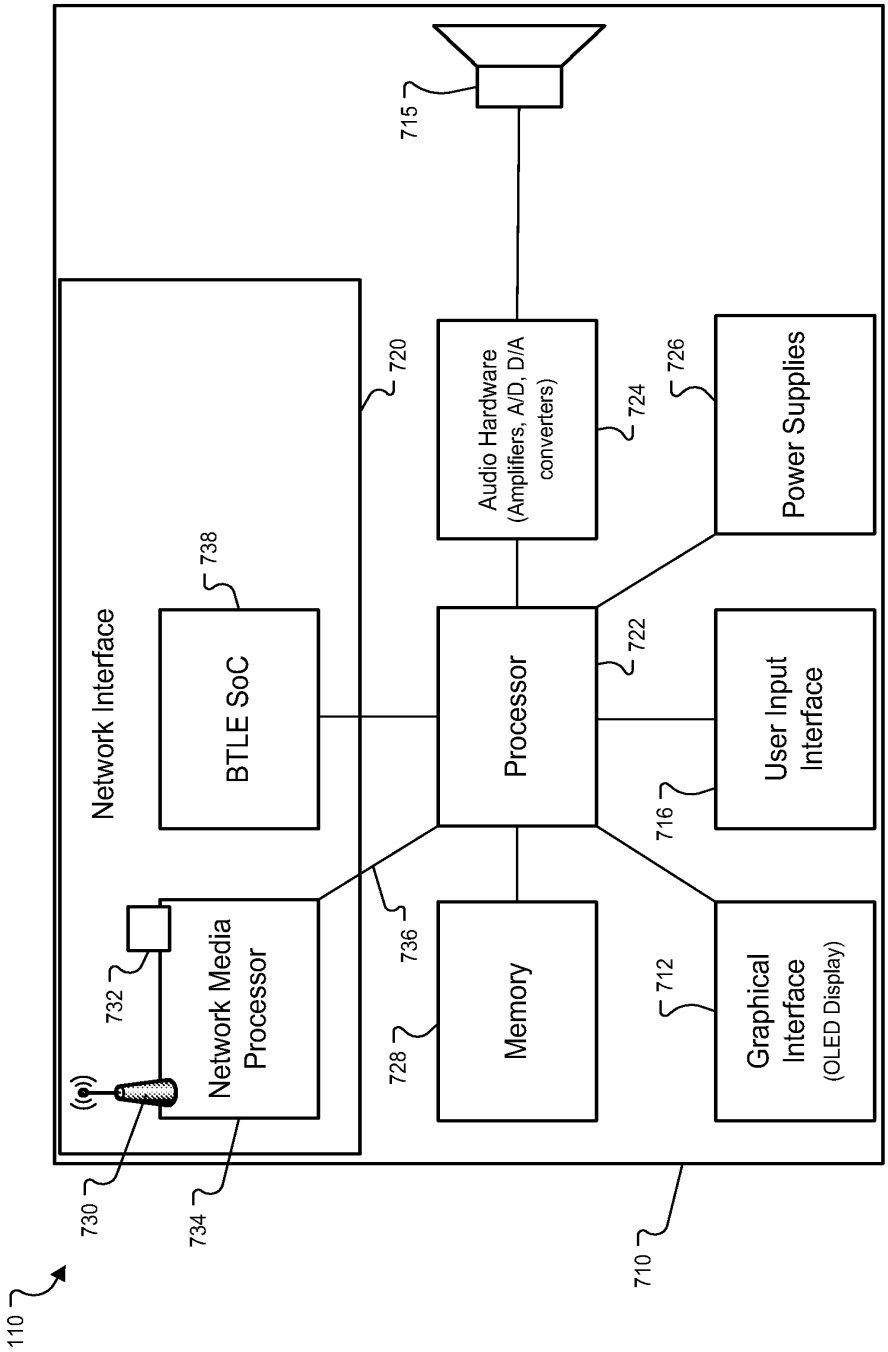

715
720
Audio Hardware (Amplifiers, A/D, D/A converters)
724
726
Power Supplies
738
Network Interface
BTLE SoC
Processor
722
User Input Interface
716
732
Network Media Processor
736
Memory
728
712
Graphical Interface (OLED Display)
730
734
710
110

FIG. 7C

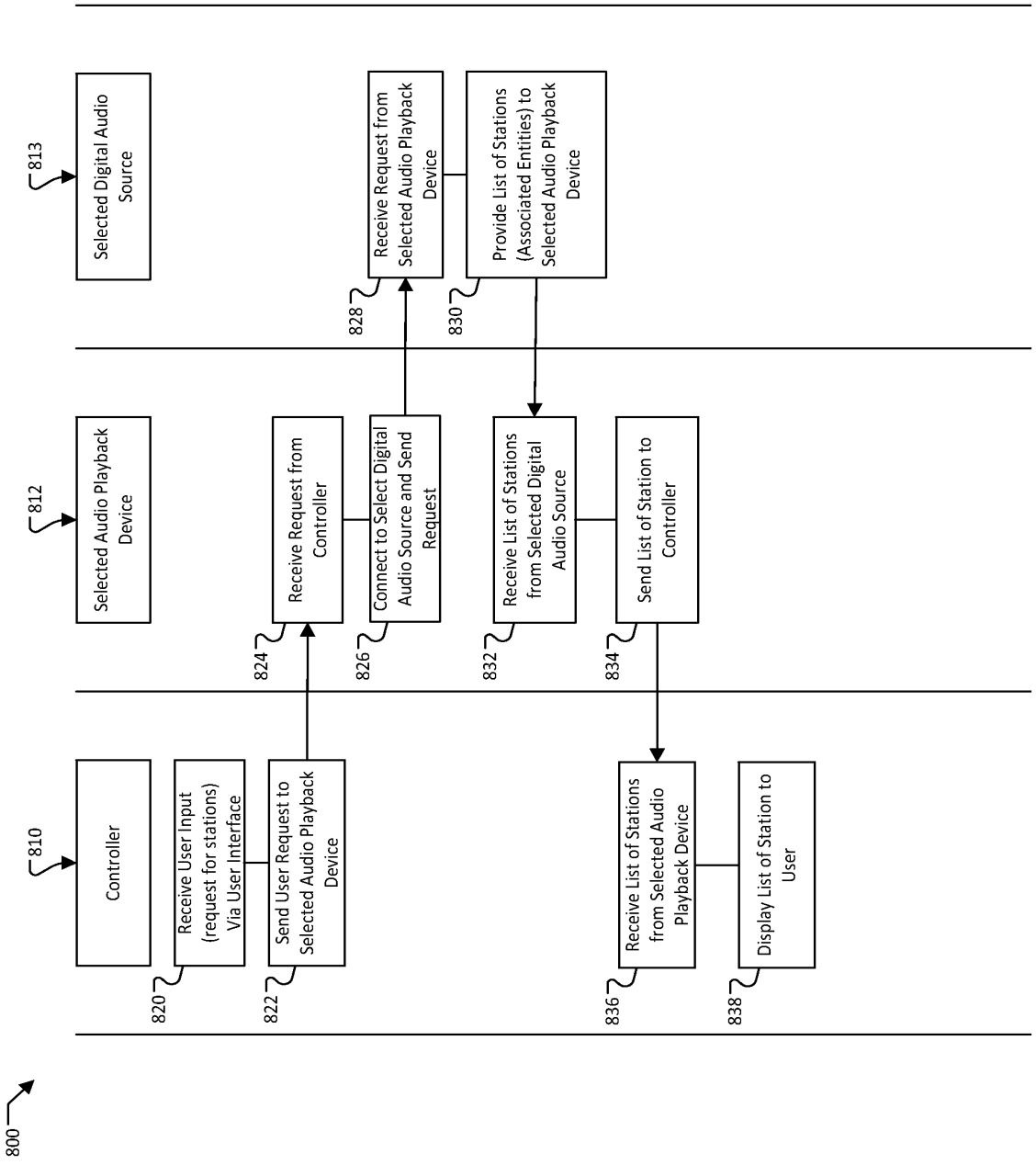

800
810
Controller
812
Selected Audio Playback Device
813
Selected Digital Audio Source
820
Receive User Input (request for stations) Via User Interface
822
Send User Request to Selected Audio Playback Device
824
Receive Request from Controller
826
Connect to Select Digital Audio Source and Send Request
828
Receive Request from Selected Audio Playback Device
830
Provide List of Stations (Associated Entities) to Selected Audio Playback Device
832
Receive List of Stations from Selected Digital Audio Source
834
Send List of Station to Controller
836
Receive List of Stations from Selected Audio Playback Device
838
Display List of Station to User

FIG. 8

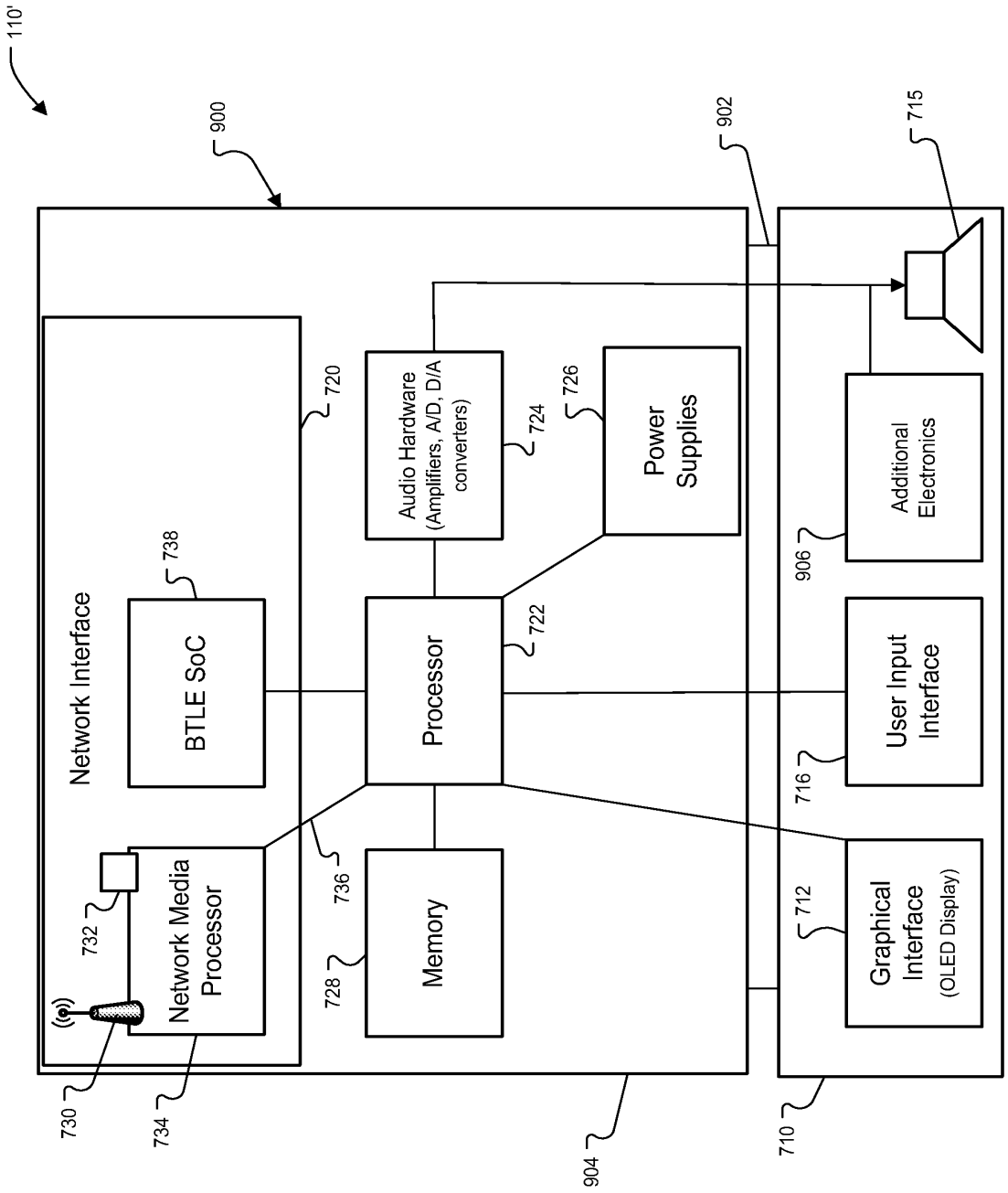

110'
900
902
715
720
Network Interface
BTLE SoC
738
Network Media Processor
732
730
734
Processor
722
Memory
736
728
Audio Hardware (Amplifiers, A/D, D/A converters)
724
Power Supplies
726
904
710
906
Additional Electronics
User Input Interface
716
Graphical Interface (OLED Display)
712

FIG. 9

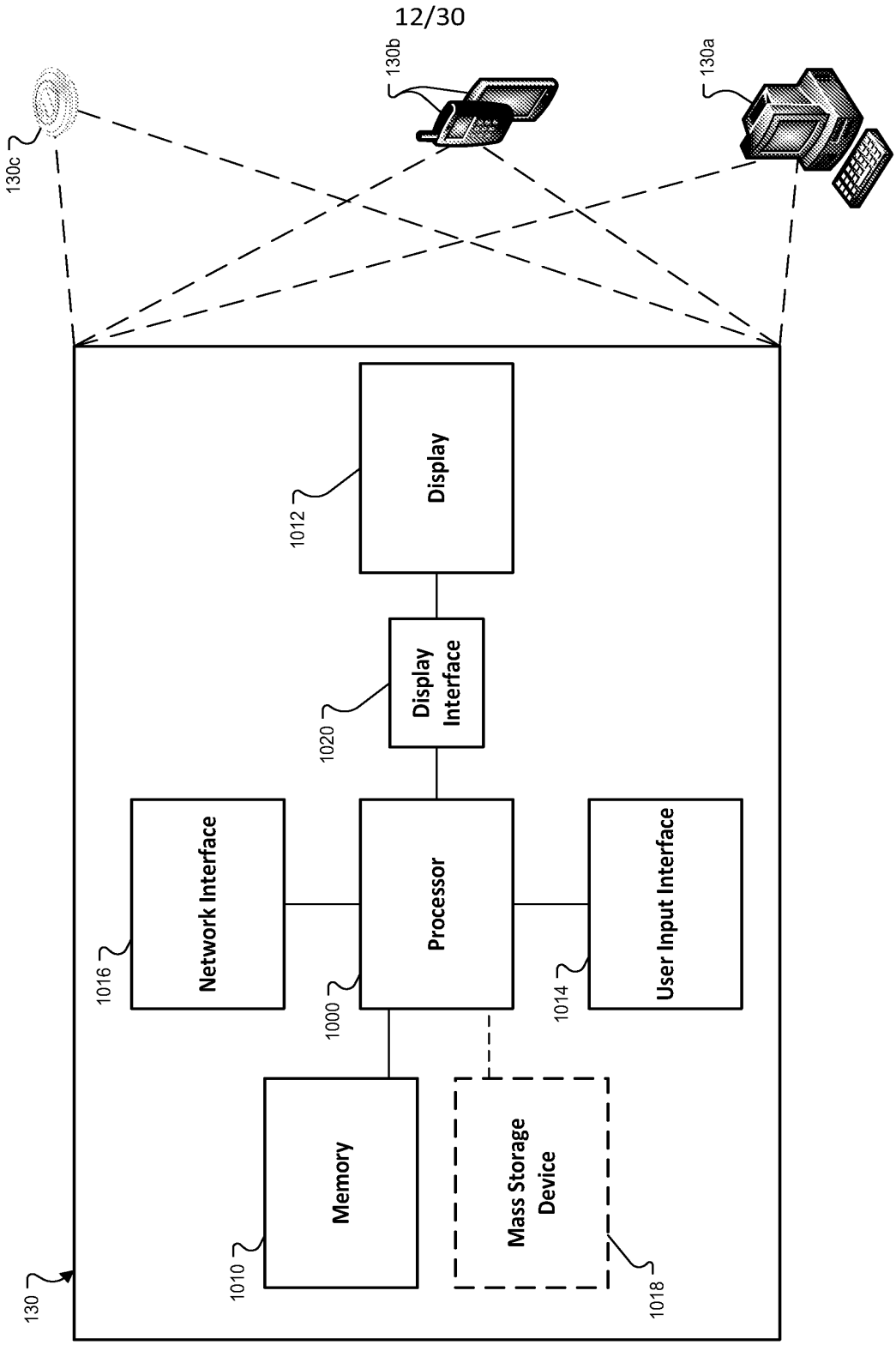

130c
130b
130a
Display
1012
Display Interface
1020
Network Interface
1016
Processor
1000
User Input Interface
1014
Memory
1010
Mass Storage Device
1018
130

FIG. 10

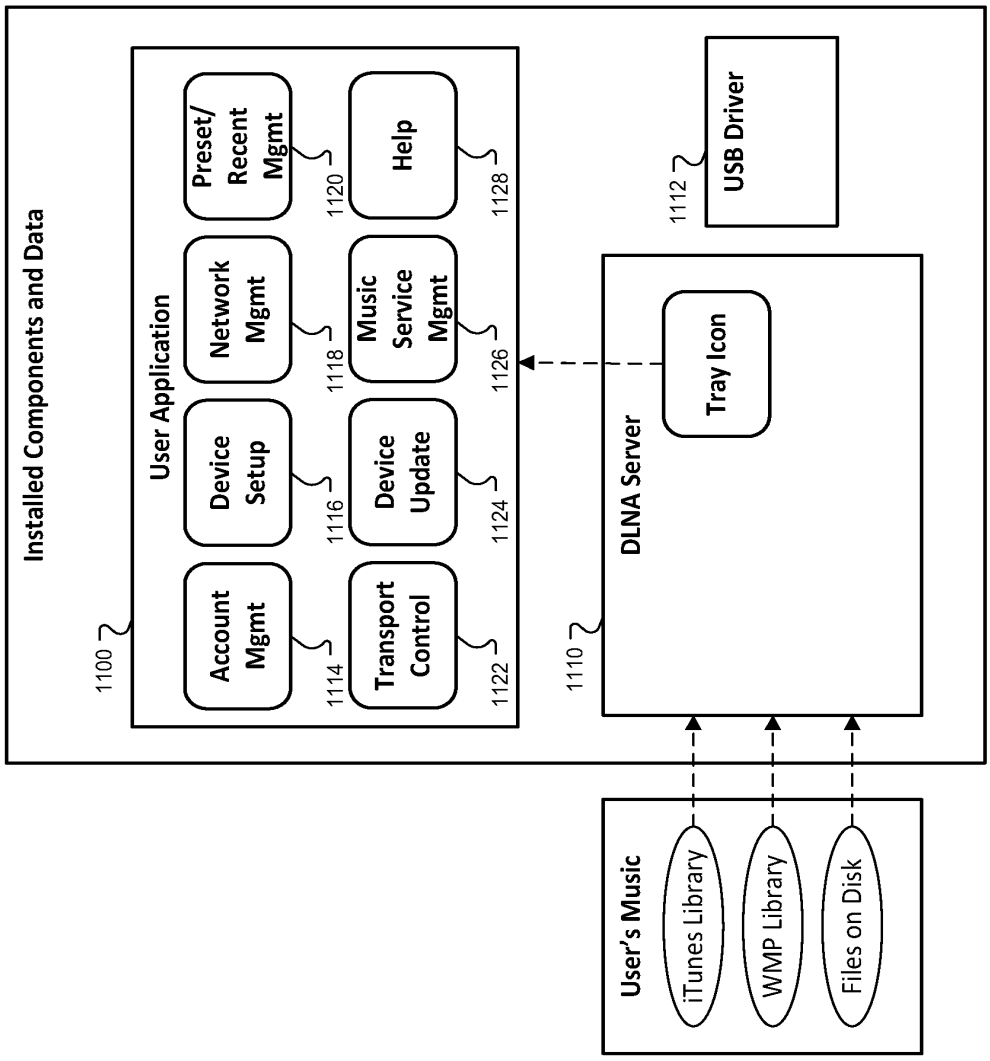

Installed Components and Data
1100
User Application
Account Mgmt
1114
Device Setup
1116
Network Mgmt
1118
Preset/ Recent Mgmt
1120
Transport Control
1122
Device Update
1124
Music Service Mgmt
1126
Help
1128
1110
DLNA Server
Tray Icon
1112
USB Driver
User's Music
iTunes Library
WMP Library
Files on Disk

FIG. 11

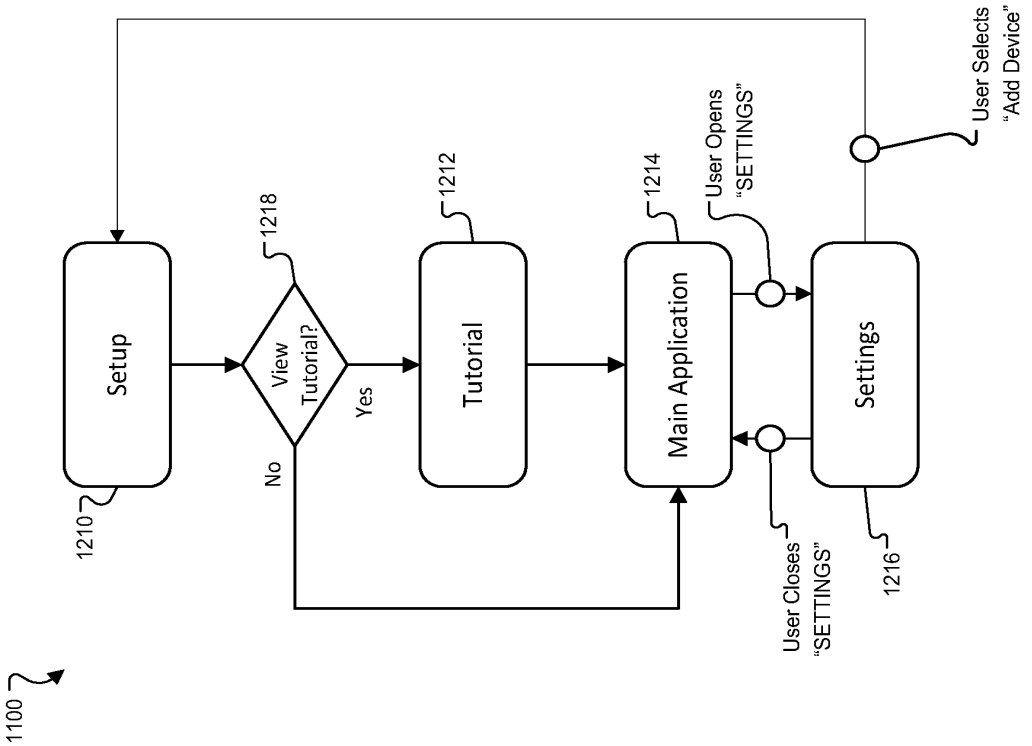

1100
Setup
1210
View Tutorial?
1218
Yes
No
Tutorial
1212
Main Application
1214
User Opens "SETTINGS"
User Closes "SETTINGS"
Settings
1216
User Selects "Add Device"

FIG. 12

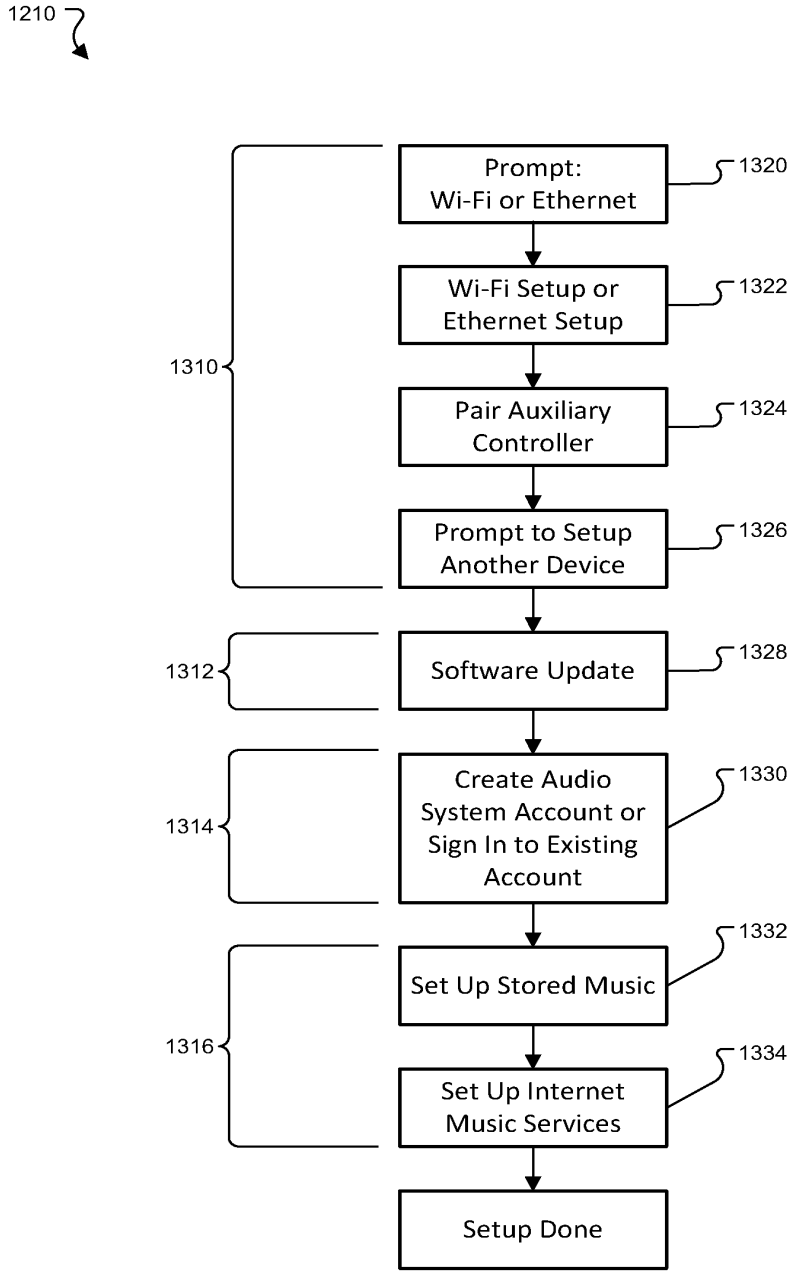

1210
Prompt:
Wi-Fi or Ethernet
1320
Wi-Fi Setup or
Ethernet Setup
1322
1310
Pair Auxiliary
Controller
1324
Prompt to Setup
Another Device
1326
1312
Software Update
1328
1314
Create Audio
System Account or
Sign In to Existing
Account
1330
1332
Set Up Stored Music
1316
1334
Set Up Internet
Music Services
Setup Done

FIG. 13

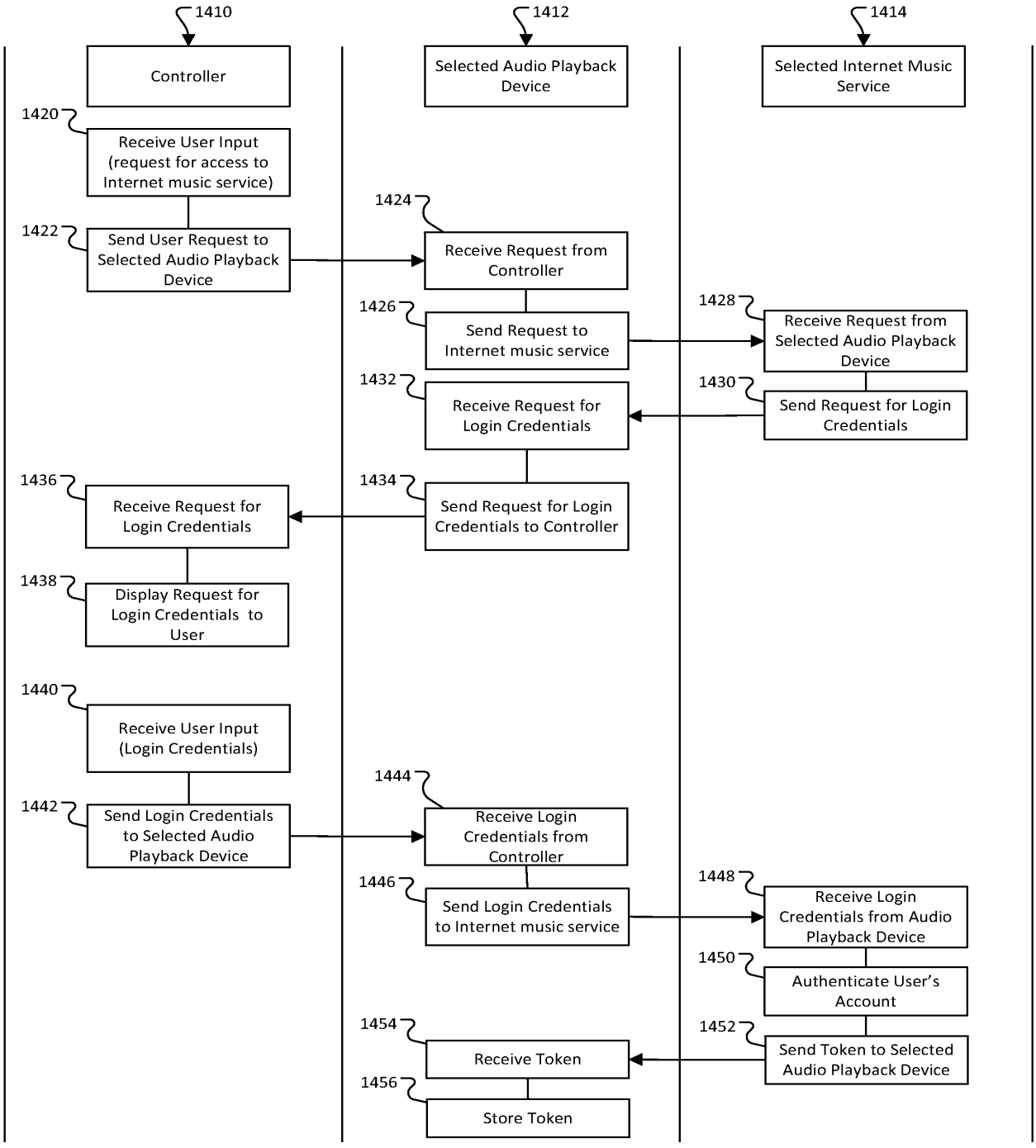

1410
Controller
1412
Selected Audio Playback Device
1414
Selected Internet Music Service
1420
Receive User Input (request for access to Internet music service)
1422
Send User Request to Selected Audio Playback Device
1424
Receive Request from Controller
1426
Send Request to Internet music service
1428
Receive Request from Selected Audio Playback Device
1430
Send Request for Login Credentials
1432
Receive Request for Login Credentials
1434
Send Request for Login Credentials to Controller
1436
Receive Request for Login Credentials
1438
Display Request for Login Credentials to User
1440
Receive User Input (Login Credentials)
1442
Send Login Credentials to Selected Audio Playback Device
1444
Receive Login Credentials from Controller
1446
Send Login Credentials to Internet music service
1448
Receive Login Credentials from Audio Playback Device
1450
Authenticate User's Account
1452
Send Token to Selected Audio Playback Device
1454
Receive Token
1456
Store Token

FIG. 14A

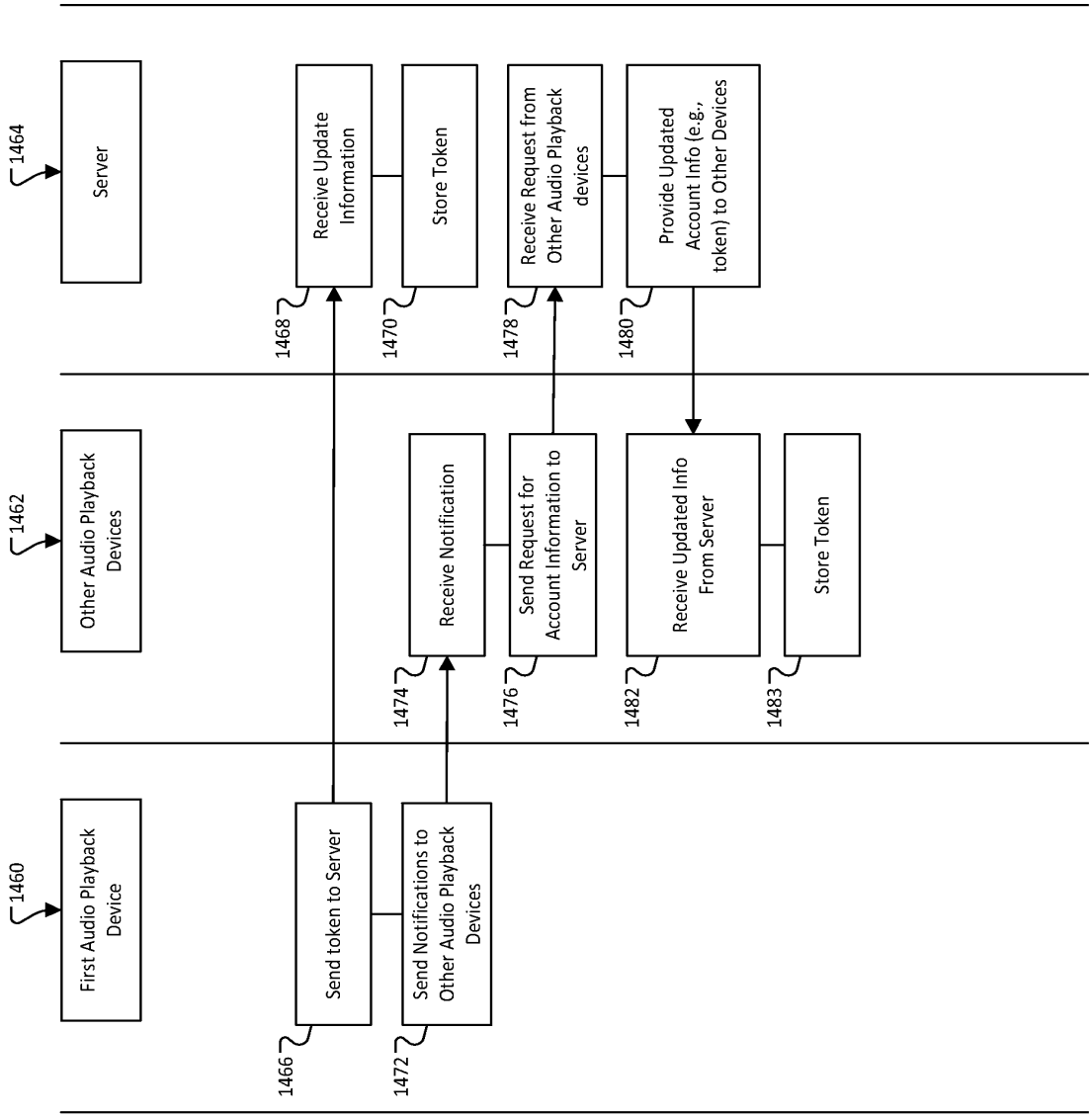

1464
Server
1462
Other Audio Playback Devices
1460
First Audio Playback Device
Receive Update Information
Store Token
Receive Request from Other Audio Playback devices
Provide Updated Account Info (e.g., token) to Other Devices
Receive Notification
Send Request for Account Information to Server
Receive Updated Info From Server
Store Token
Send token to Server
Send Notifications to Other Audio Playback Devices
1468
1470
1478
1480
1474
1476
1482
1483
1466
1472

FIG. 14B

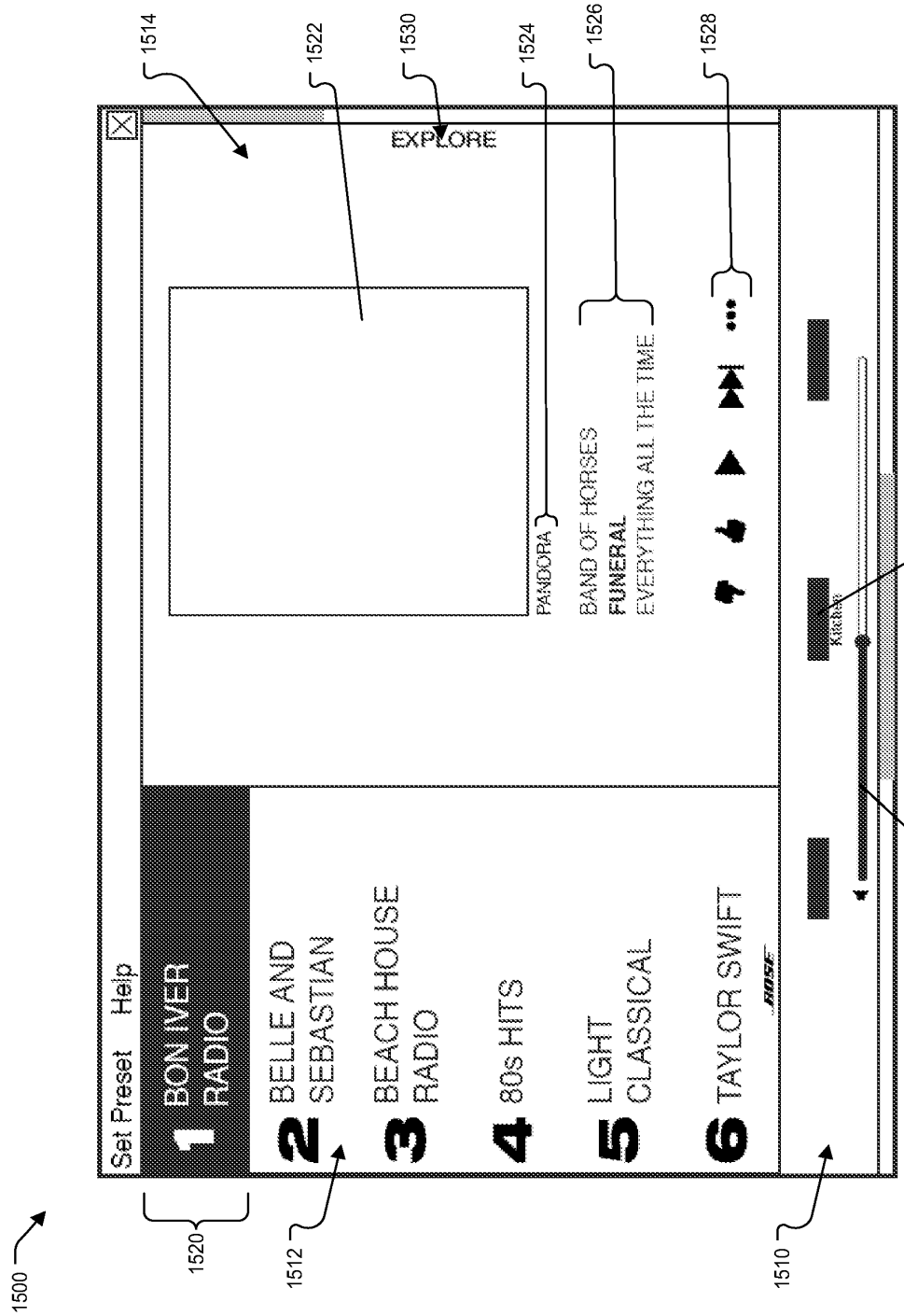

1500
1510
1512
1514
1516
1518
1520
1522
1524
1526
1528
1530
Set Preset
Help
1 BON IVER RADIO
2 BELLE AND SEBASTIAN
3 BEACH HOUSE RADIO
4 80s HITS
5 LIGHT CLASSICAL
6 TAYLOR SWIFT
EXPLORE
PANDORA
BAND OF HORSES
FUNERAL
EVERYTHING ALL THE TIME
Kitchen

FIG. 15A

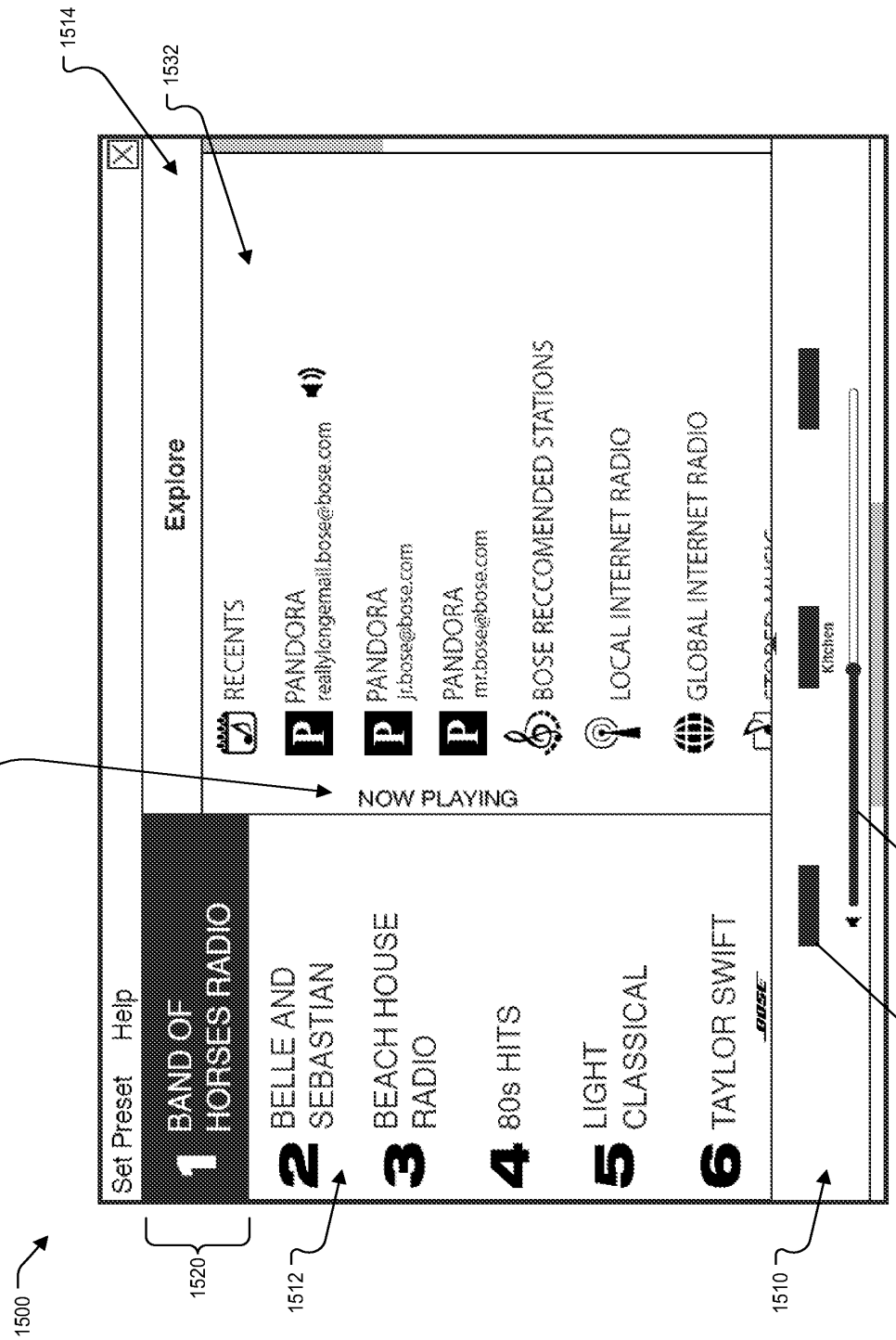

1514
1532
1534
1500
1520
1512
1510
1516
1518
Set Preset
Help
Explore
NOW PLAYING
1 BAND OF HORSES RADIO
2 BELLE AND SEBASTIAN
3 BEACH HOUSE RADIO
4 80s HITS
5 LIGHT CLASSICAL
6 TAYLOR SWIFT
RECENTS
PANDORA
reallylongemail.bose@bose.com
PANDORA
jr.bose@bose.com
PANDORA
mr.bose@bose.com
BOSE RECCOMENDED STATIONS
LOCAL INTERNET RADIO
GLOBAL INTERNET RADIO
Kitchen

FIG. 15B

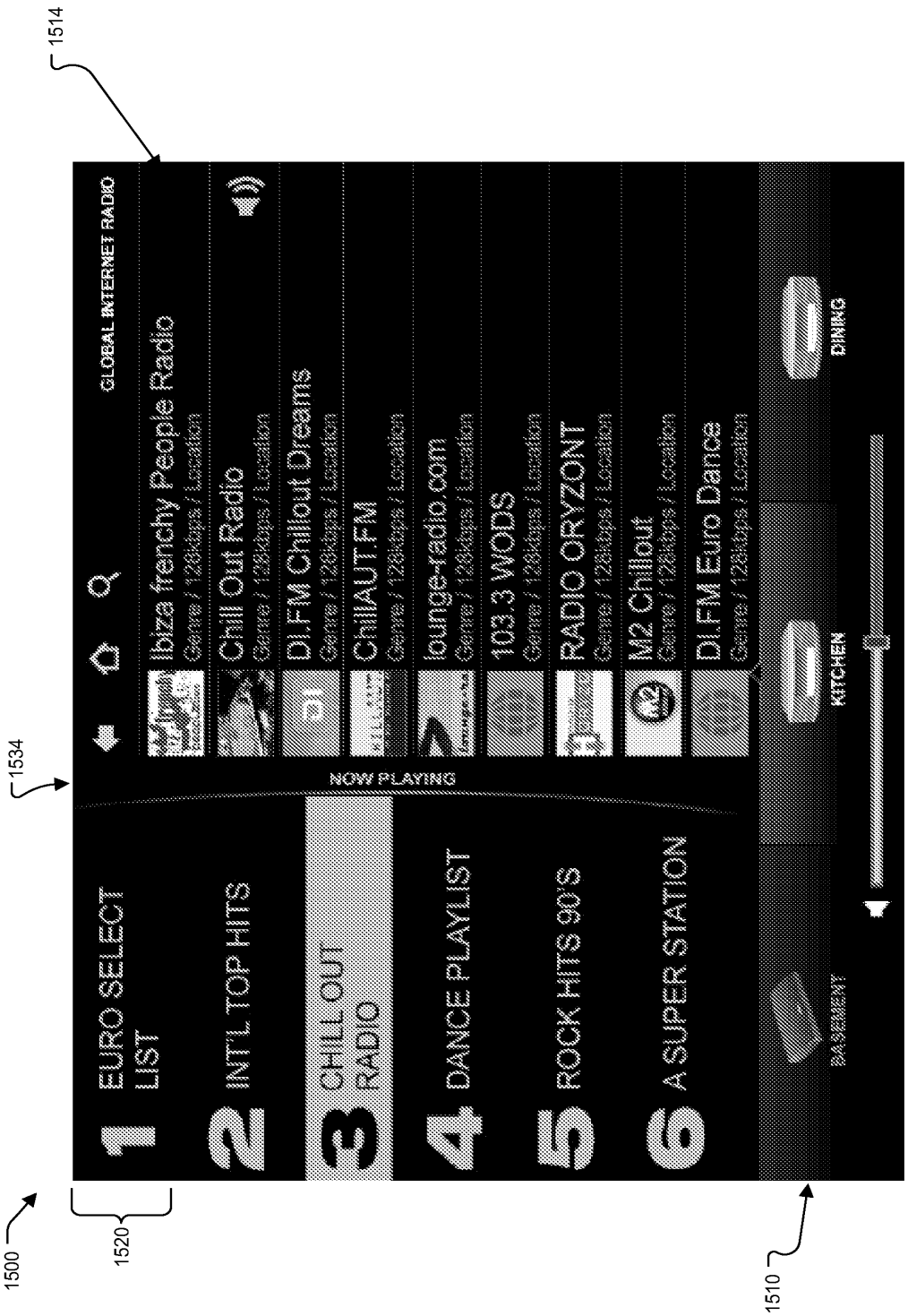

1514
1534
1500
1520
1510
GLOBAL INTERNET RADIO
NOW PLAYING
1 EURO SELECT LIST
2 INT'L TOP HITS
3 CHILL OUT RADIO
4 DANCE PLAYLIST
5 ROCK HITS 90'S
6 A SUPER STATION
Ibiza frenchy People Radio
Chill Out Radio
DI.FM Chillout Dreams
ChillAUT.FM
lounge-radio.com
103.3 WODS
RADIO ORYZONT
M2 Chillout
DI.FM Euro Dance
Genre / 128kbps / Location
DINING
KITCHEN
BASEMENT

FIG. 15C

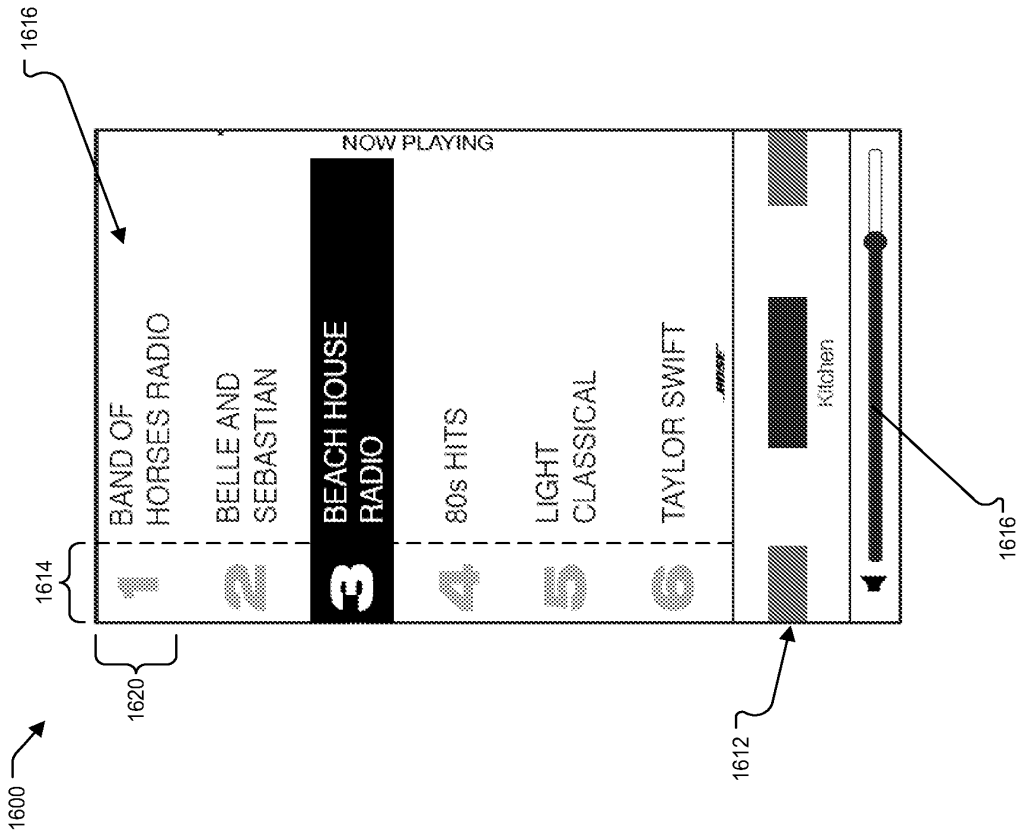

1600
1620
1614
1616
1612
1616
NOW PLAYING
1 BAND OF HORSES RADIO
2 BELLE AND SEBASTIAN
3 BEACH HOUSE RADIO
4 80s HITS
5 LIGHT CLASSICAL
6 TAYLOR SWIFT
Kitchen

FIG. 16A

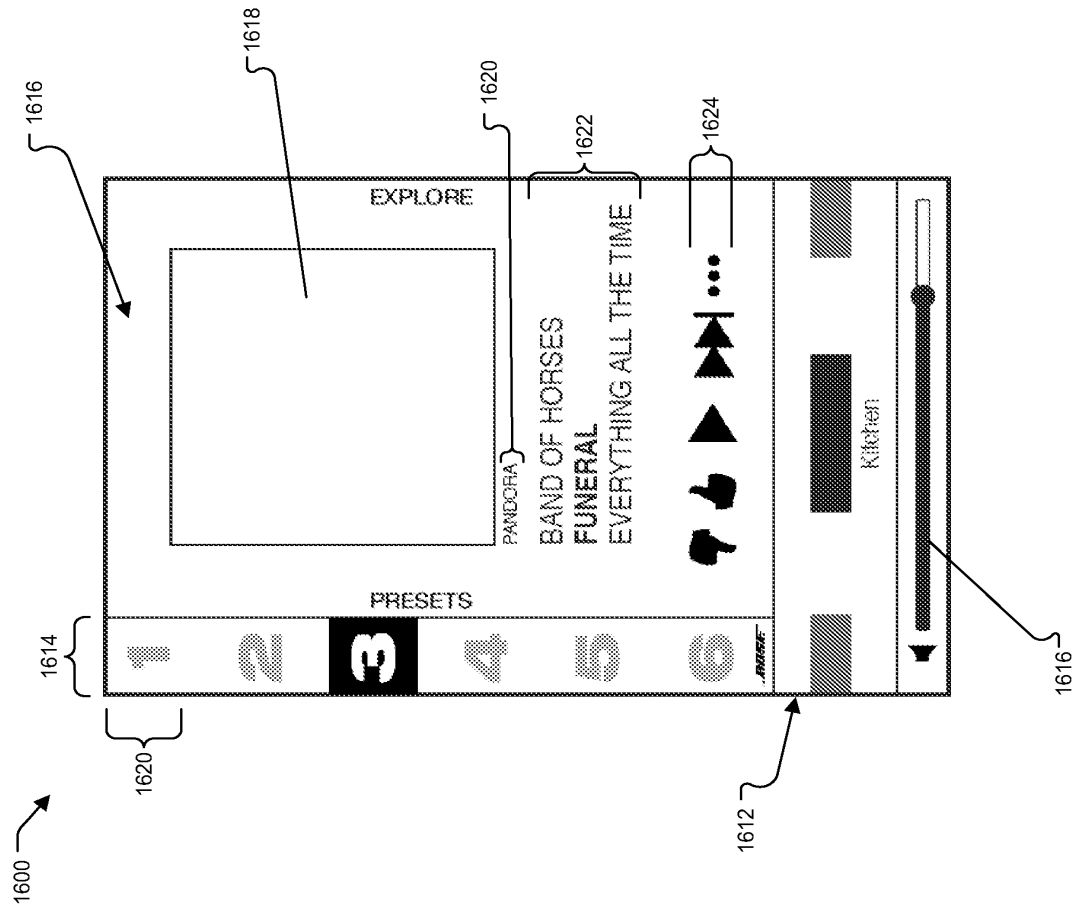

1600
1612
1614
1616
1618
1620
1622
1624
EXPLORE
PANDORA
BAND OF HORSES
FUNERAL
EVERYTHING ALL THE TIME
Kitchen
PRESETS
1
2
3
4
5
6

FIG. 16B

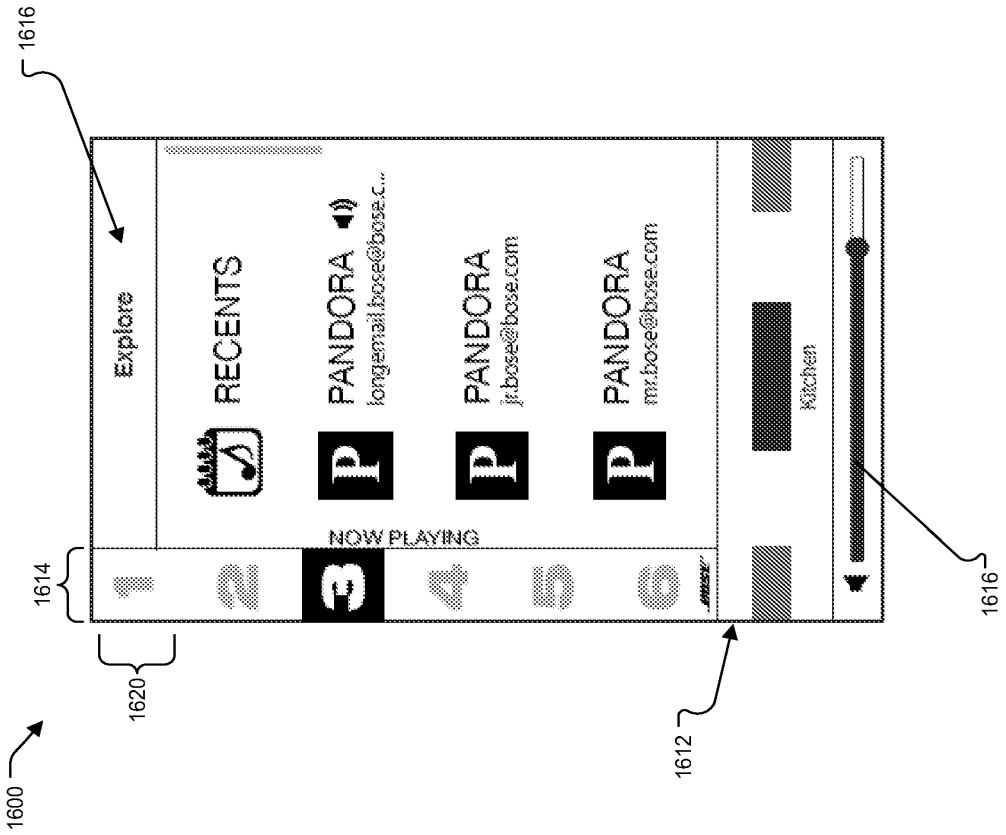

1616
Explore
RECENTS
PANDORA
longemail.bose@bose.c...
PANDORA
jr.bose@bose.com
PANDORA
mr.bose@bose.com
NOW PLAYING
1
2
3
4
5
6
Kitchen
1614
1620
1600
1612
1616

FIG. 16C

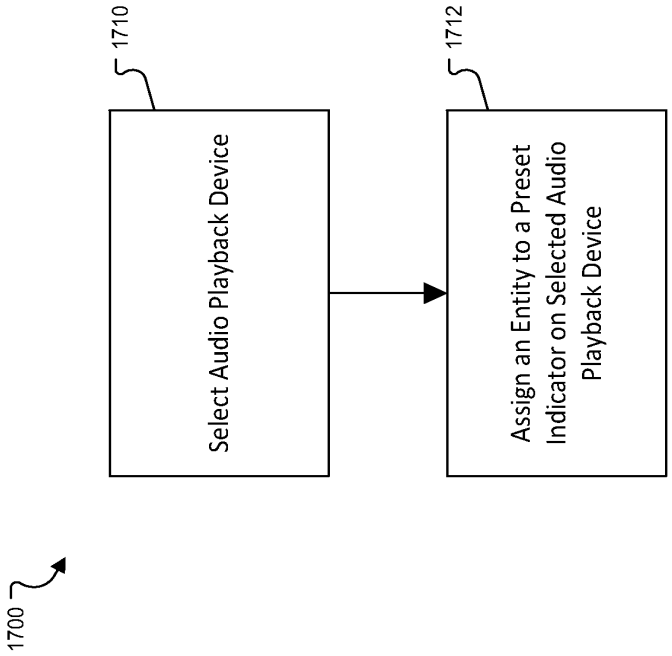

1700
1710
Select Audio Playback Device
1712
Assign an Entity to a Preset Indicator on Selected Audio Playback Device

FIG. 17

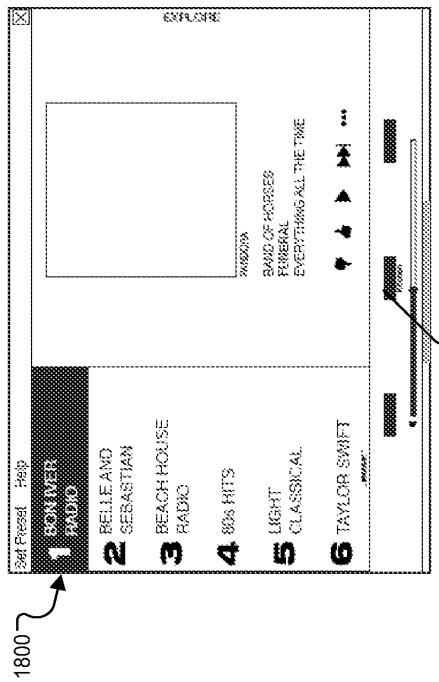


FIG. 18B

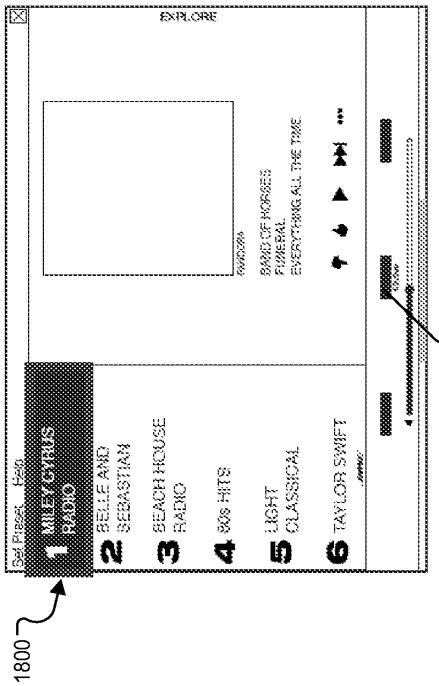


FIG. 18A

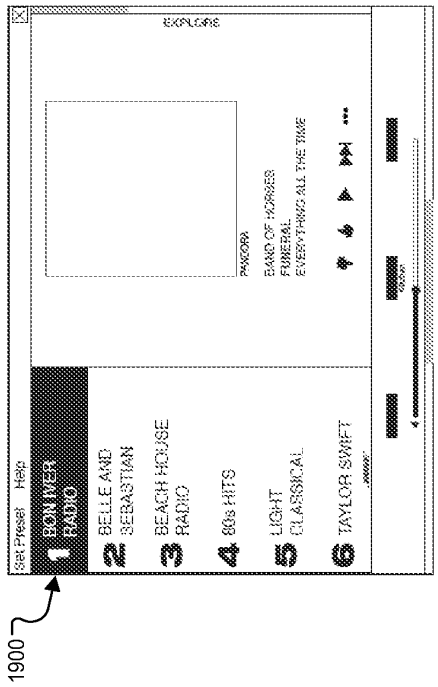


FIG. 19B

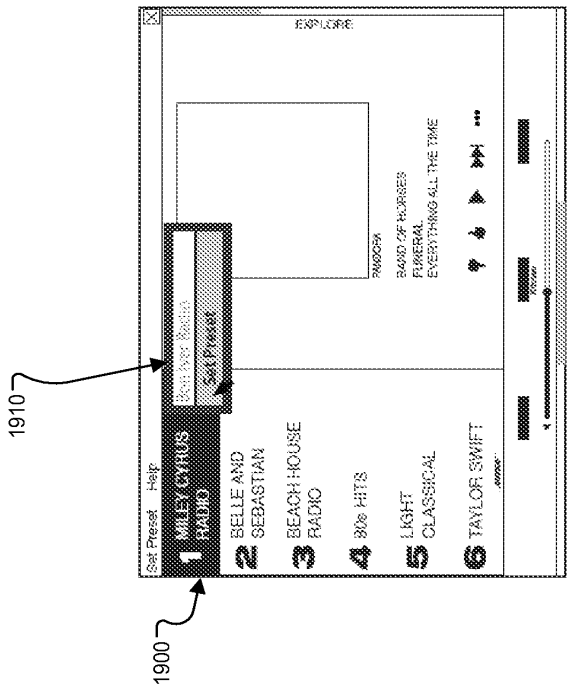


FIG. 19A

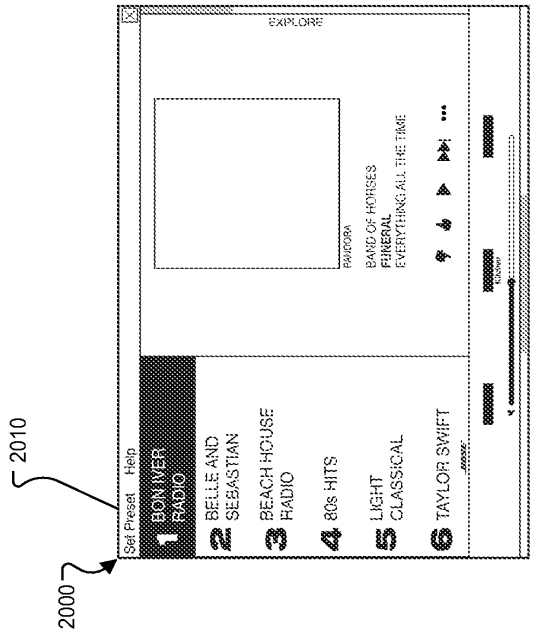


FIG. 20B

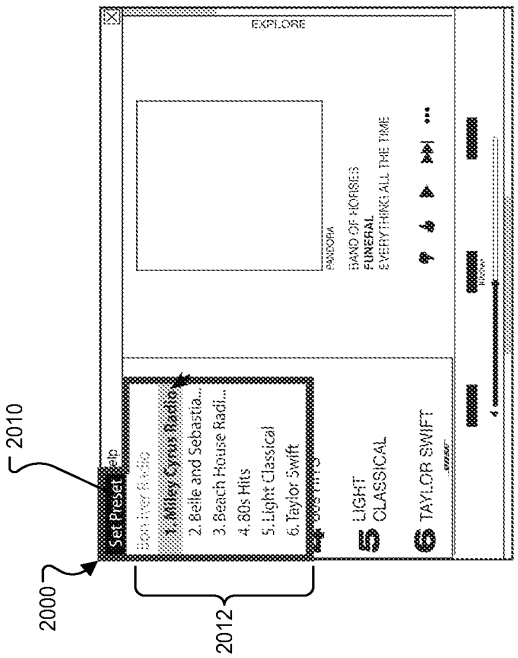


FIG. 20A

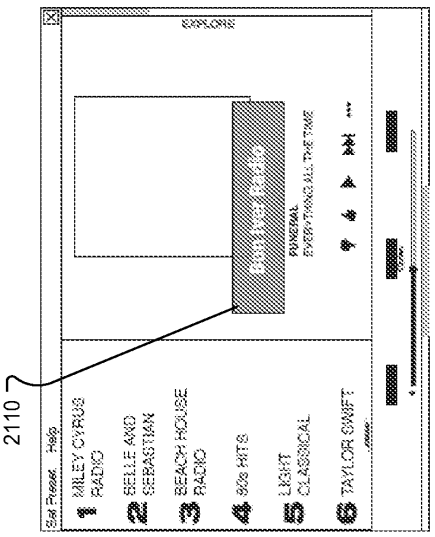


FIG. 21B

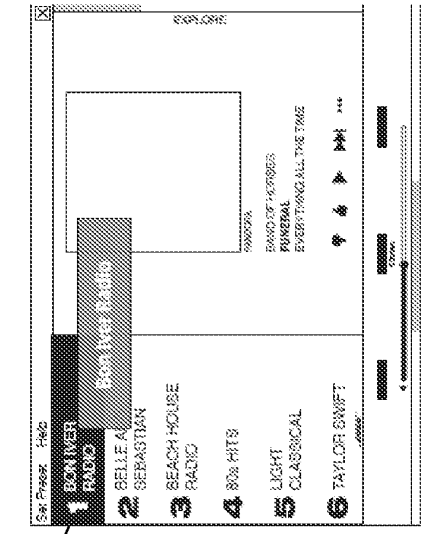


FIG. 21C

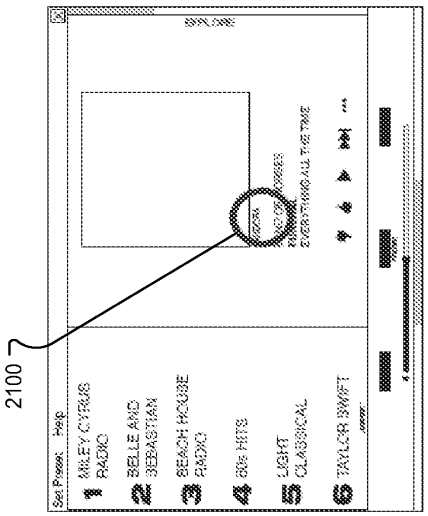


FIG. 21A

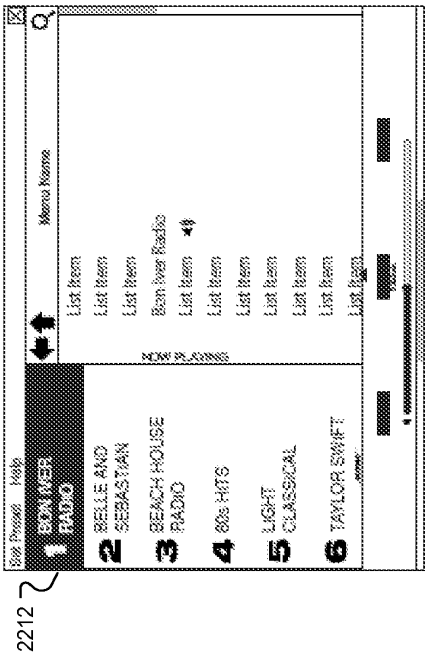


FIG. 22B

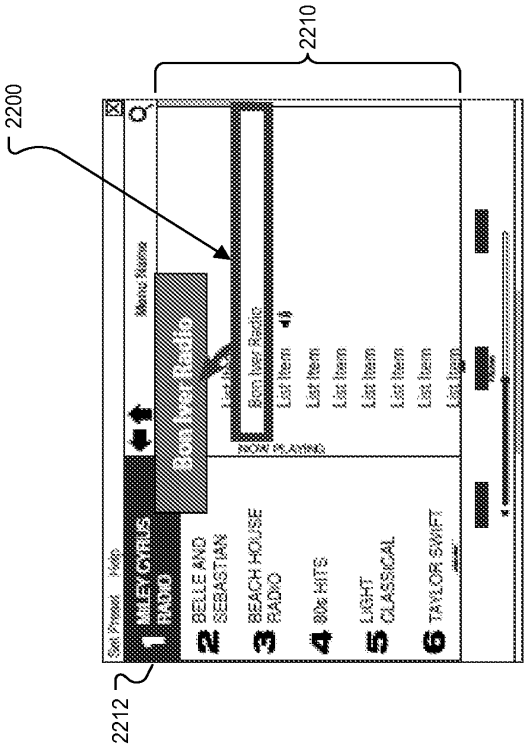


FIG. 22A

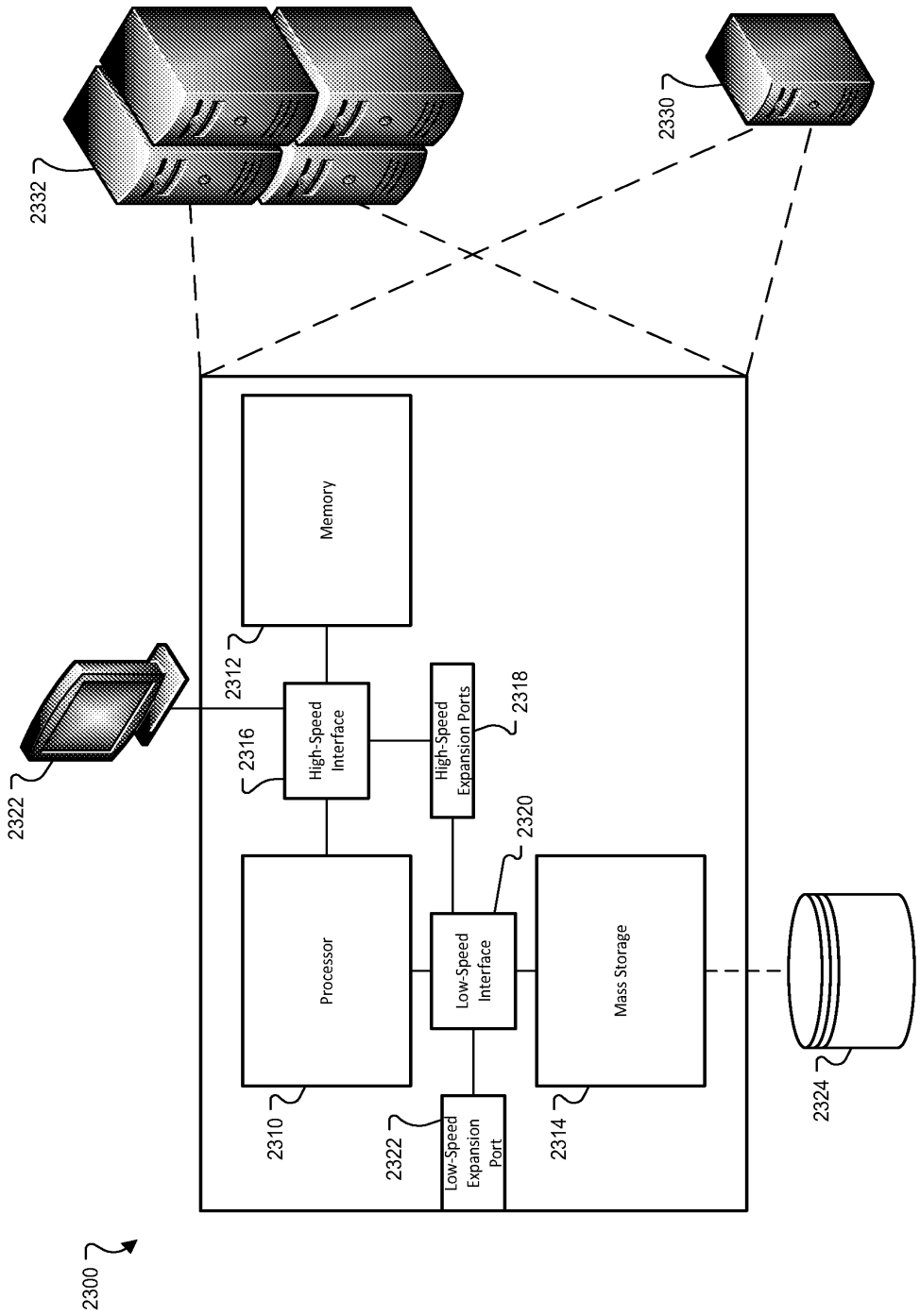

2332
2330
Memory
2312
2322
2316
High-Speed Interface
High-Speed Expansion Ports
2318
2320
Processor
Low-Speed Interface
Mass Storage
2324
2310
2322
Low-Speed Expansion Port
2314
2300

FIG. 23

Electronic Acknowledgement Receipt	
EFS ID:	30223355
Application Number:	90013959
International Application Number:	
Confirmation Number:	9548
Title of Invention:	OBTAINING CONTENT FROM REMOTE SOURCE FOR PLAYBACK
First Named Inventor/Applicant Name:	9213357
Customer Number:	107361
Filer:	John Gerrard Tolomei/Jeffrey P. Armstrong
Filer Authorized By:	John Gerrard Tolomei
Attorney Docket Number:	04-0401-REEXAM (14-1800-R
Receipt Date:	31-AUG-2017
Filing Date:	16-JUN-2017
Time Stamp:	18:37:30
Application Type:	Reexam (Patent Owner)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Foreign Reference	WO2012050927.PDF	21146172 0cc60d7a591c6fc5361e2caf623289fdb5939baa	no	386
Warnings:					

Information:					
2	Foreign Reference	WO2014004182.PDF	2037255 300230e07c41979daf09d809d507a13c449515a8	no	49
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3	Foreign Reference	WO2014149533.PDF	3677125 bd4da631ed015fcc74fc3544541f18b0689ac174	no	93
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4	Non Patent Literature	14516867_FINAL_OA_3-9-15.PDF	493096 059c76ba532423754d5e60deb579f0db84d78610	no	14
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5	Non Patent Literature	15243355_FOA_4-10-17_15PAGES.PDF	554240 550be7a3a495b46f69b2b43c4caeeab7715b83ca	no	15
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14	Non Patent Literature	11147116_FOA_8-14-09_28pages.PDF	900870 1a59d6c409e3b7fa2671b581c7a625fef881541e	no	28
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16	Non Patent Literature	15228639_FOA_04-0401-CON0716_6-15-17_16PAGES.PDF	527942 7dc65e16c20f44460c585c26694f91960b8b9d56	no	16
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24	Non Patent Literature	11906702_FOA_01-21-2010.PDF	962767 1fbea73221e6b7e15176d6edd956ce73b6e177c1	no	27
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25	Non Patent Literature	14186850_FINAL_OA_10-22-14.PDF	411504 0111d963f9d3616d664239ca97e701933b9bf797	no	12
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26	Non Patent Literature	11147116_FOA_12-24-09_29pages.PDF	948435 222b0be58593984bb495884d43d3051d218fa677	no	29
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36	Non Patent Literature	FIREBALL_SE-D1_USERS_MANUAL_90PAGES-V2.PDF	5386467 bfef43f6b10b2a0a1ee1e428cf2674521a6da52e	no	90
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38	Non Patent Literature	FOBER_2002.PDF	5007222 5f214db04c51837d99199871192f4e8a19f7cc7e	no	4
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39	Non Patent Literature	FOUT_MICROSSOFT_CLIENT_SUPPORT_2001.PDF	2932173 94867cbaa0a48e73f38909bef719fb0e6654fea4	no	18
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40	Non Patent Literature	MP3_INTERNETAUDIOHANDBOOK_2000_320PAGES_PART1OF2.PDF	14183519 8155caed552e0ac091f4aacb481b1a4489d37bae	no	150
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41	Non Patent Literature	MP3_INTERNETAUDIOHANDBOOK_2000_320PAGES-PART2OF2.PDF	16797286 eae1a55bbb3325f947504074d441350031201fc0	no	170
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43	Non Patent Literature	GASTON_2008.PDF	25429712 8f48f6bffa176f231fa3838b8f53f15ffffff2b2	no	15
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44	Non Patent Literature	GENERAL_EVENT_NOTIFICATION_ARCHITECTURE_BASE_2000_23PAGES.PDF	51980 906c2b6278a8d07fdeb95cde5d9e83306e6ce288	no	23
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48	Non Patent Literature	CINEMA_SOURCE_HOME_THEATER_2002.PDF	3485720 7d6c8c54b1684b579238cff0eff6bd3a900fd67a	no	19
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50	Non Patent Literature	HUANG_IEEETRANSCONSUMERELECTRONICS_1997_43_370.PDF	1084328 c152a1dd1436c3f73ce7fd10a5d0fc30045581f2	no	11
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51	Non Patent Literature	IBM_HOME_DIRECTOR_INSTALLATION_SERVICE_MANUAL_124PAGES.PDF	15956473 6314f1dcdf5f68d65ea8e226786d3d84300dd585	no	124
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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

(19) Canadian Intellectual Property Office
An Agency of Industry Canada

Office de la Propri,t, Intellectuelle du Canada
Un organisme d'Industrie Canada

(11) **CA 2 320 451** (13) **A1**

(40) **23.03.2001**
(43) **23.03.2001**

(12)

(21) **2 320 451**

(51) Int. Cl.7: **H04R 3/12**, H04S 7/00

(22) **22.09.2000**

(30) **2,283,577 CA 23.09.1999**

(71) **BONNEVILLE, MARC ETIENNE,**
3020 Quillivan Drive, CUMBERLAND, O1 (CA).

(72) **BONNEVILLE, MARC ETIENNE (CA).**

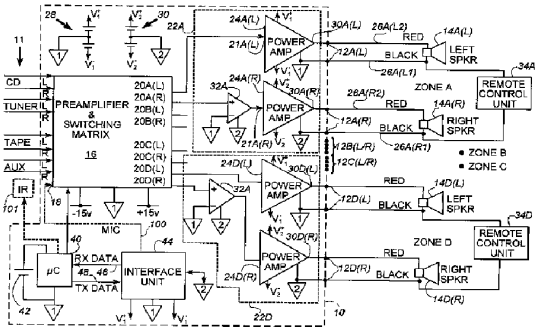
(74) **THOMAS ADAMS & ASSOC.**

(54) TRANSMISSION DE LA PUISSANCE ET/OU DU SIGNAL ENTRE UN CENTRE DE DISTRIBUTION AUDIO ET PLUSIEURS TRANSDUCTEURS AUDIO ELOIGNES

(54) TRANSMISSION OF POWER AND/OR SIGNALLING BETWEEN AN AUDIO DISTRIBUTION UNIT AND A PLURALITY OF REMOTE AUDIO TRANSDUCERS

(57)

A remote-controlled audio system comprises sets of loudspeakers (14A-14D) connected to power amplifier units (22A - 22D) in an audio distribution unit (10) to which several audio sources, such as a compact disc unit, a tape deck, etc., are connected. Remote units (34) are provided, one in each zone with a set of loudspeakers. The loudspeakers and the remote unit are connected to the audio distribution unit by four wires whereby audio and data signals and power are transmitted to the loudspeakers and the remote unit, respectively. Each power amplifier unit may have a pair of power amplifiers, each connected to one of the loudspeakers in the set, referenced to a first ground (1) and a second ground (2), respectively. The second ground (2) is maintained at a prescribed voltage relative to the first ground. The remote unit (34A) is connected between the "ground" terminals of the two loudspeakers of the set, i.e. those connected via the speaker cables to the first and second grounds in the audio distribution unit. The remote unit has a transmitter unit which transmits control signals to the audio distribution unit via the "ground" cables. In the audio distribution unit, an interface circuit connected between the grounds conveys the control signals to a control device which adjusts the settings of the audio distribution unit in dependence thereupon. The remote units may receive power from the audio distribution unit via the transmission channel to supply their internal components.



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Office de la propriété intellectuelle du Canada

CIPO
Canadian Intellectual Property Office

(12) (19) (CA) **Demande-Application**

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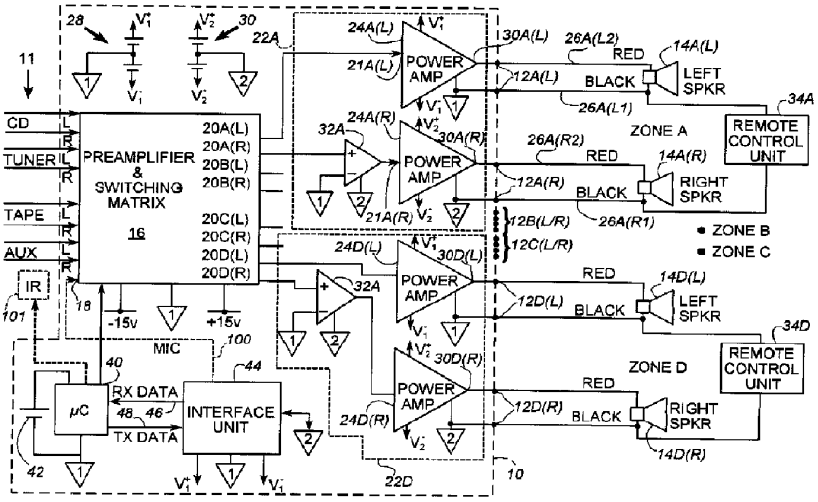
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(54) **TRANSMISSION DE LA PUISSANCE ET/OU DU SIGNAL ENTRE UN CENTRE DE DISTRIBUTION AUDIO ET PLUSIEURS TRANSDUCTEURS AUDIO ELOIGNES**

(54) **TRANSMISSION OF POWER AND/OR SIGNALLING BETWEEN AN AUDIO DISTRIBUTION UNIT AND A PLURALITY OF REMOTE AUDIO TRANSDUCERS**



(57) A remote-controlled audio system comprises sets of loudspeakers (14A-14D) connected to power amplifier units (22A - 22D) in an audio distribution unit (10) to which several audio sources, such as a compact disc unit, a tape deck, etc., are connected. Remote units (34) are provided, one in each zone with a set of loudspeakers. The loudspeakers and the remote unit are connected to the audio distribution unit by four wires whereby audio and data signals and power are transmitted to the loudspeakers and the remote unit, respectively. Each power amplifier unit may have a pair of power amplifiers, each connected to one of the loudspeakers in the set, referenced to a first ground (1) and a second ground (2), respectively. The second ground (2) is maintained at a prescribed voltage relative to the first ground. The remote unit (34A) is connected between the "ground" terminals of the two loudspeakers of the set, i.e. those connected via the speaker cables to the first and second grounds in the audio distribution unit. The remote unit has a transmitter unit which transmits control signals to the audio distribution unit via the "ground" cables. In the audio distribution unit, an interface circuit connected between the grounds conveys the control signals to a control device which adjusts the settings of the audio distribution unit in dependence thereupon. The remote units may receive power from the audio distribution unit via the transmission channel to supply their internal components.

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ABSTRACT OF THE DISCLOSURE

A remote-controlled audio system comprises sets of loudspeakers (14A - 14D) connected to power amplifier units (22A - 22D) in an audio distribution unit (10) to which several audio sources, such as a compact disc unit, a tape deck, etc., are connected. Remote units (34) are provided, one in each zone with a set of loudspeakers. The loudspeakers and the remote unit are connected to the audio distribution unit by four wires whereby audio and data signals and power are transmitted to the loudspeakers and the remote unit, respectively. Each power amplifier unit may have a pair of power amplifiers, each connected to one of the loudspeakers in the set, referenced to a first ground (1) and a second ground (2), respectively. The second ground (2) is maintained at a prescribed voltage relative to the first ground. The remote unit (34A) is connected between the "ground" terminals of the two loudspeakers of the set, i.e. those connected via the speaker cables to the first and second grounds in the audio distribution unit. The remote unit has a transmitter unit which transmits control signals to the audio distribution unit via the "ground" cables. In the audio distribution unit, an interface circuit connected between the grounds conveys the control signals to a control device which adjusts the settings of the audio distribution unit in dependence thereupon. The remote units may receive power from the audio distribution unit via the transmission channel to supply their internal components.

TRANSMISSION OF POWER AND/OR SIGNALLING BETWEEN AN AUDIO DISTRIBUTION UNIT AND A PLURALITY OF REMOTE AUDIO TRANSDUCERS

BACKGROUND OF THE INVENTION

TECHNICAL FIELD

The invention relates to the transmission of power and/or signalling between an audio distribution unit and a plurality of remote audio transducers and is especially applicable to multi-zone audio systems or entertainment centres comprising an audio distribution unit for driving several sets of loudspeakers in different zones, such as different rooms of a house.

BACKGROUND ART

A multi-zone audio/entertainment system may have a plurality of loudspeaker sets, each set located in a different zone, such as a room of a house or other building. Typically, such a system comprises an audio distribution unit having inputs for audio signals from several sources (tuner, CD player, tape player, etc.), output ports for connection to the sets of loudspeakers, and a switching matrix for connecting the sources to respective ones of the loudspeaker sets. Some known systems provide local control of volume by means of an autotransformer, but these are susceptible to distortion, heating and poor frequency response. It is desirable for the user to be able to control settings of the audio distribution unit from the zones where the loudspeakers are located.

It is known to provide remote control of audio source selection, volume and tone control, balance adjustment, and so on, by means of keypad units, one for each zone. Each keypad unit communicates with a microcontroller in the audio distribution unit to provide control of most of its functions. A disadvantage of such systems is that each keypad unit is connected to the audio distribution unit by a multi-conductor cable which comprises some conductors for exchanging control signals between the remote keypad unit and the audio distribution unit, and others for supplying power from the audio distribution unit to the remote keypad unit. It is expensive to provide such multi-conductor cabling for every keypad, and such expense is especially

unacceptable when adding remote control to an existing multi-zone loudspeaker system, which usually would require installation of multi-conductor cables in addition to existing two-conductor loudspeaker cables.

It is also known to use wireless communication links between remote control units and an audio distribution unit. Disadvantageously, however, the radio frequency circuitry is relatively expensive and susceptible to interference, and the remote control unit requires a local power supply. Also, speaker drive conductors would usually still be required unless the audio drive also used wireless links. The latter systems either are expensive or deliver poor quality results.

SUMMARY OF THE INVENTION

The present invention seeks to eliminate, or at least mitigate, the disadvantages of these known remote control systems.

According to one aspect of the present invention, there is provided apparatus comprising an audio distribution unit (10) having means (11) for providing audio signals from audio sources and output ports (12A...12D) for supplying sets of audio transducers, each said set comprising at least a first audio transducer (14A(L)) and a second audio transducer (14A(R)) and having associated therewith at least one remote unit (34A), the first and second audio transducers (14A(L),14A(R)) and the remote unit (34A) being connected to the audio distribution unit (10) by a set of four conductors, the apparatus further comprising means (22A...22D,44,76,80-96) for supplying audio signals to the audio transducers (14A(L),14A(R)) and transferring at least one of power and data signals between said audio distribution unit (10) and said remote unit (34A), all by way of the four conductors.

In one embodiment of this first aspect, the audio distribution unit (10) comprises first and second power amplifiers (24A(L),24A(R)), a first conductor (26A(L1)) connects one terminal of each of said first and second audio transducers (14A(L),14A(R)) and one terminal of the remote unit (34A) to a ground terminal of the audio distribution unit (10), a second (26A(L2)) of the conductors connects a drive-signal terminal of said first audio transducer (14A(L)) to a corresponding output terminal (30A(L)) of said first power

amplifier (24A(L)), a third conductor (26A(R1)') connects a second terminal of the remote unit (34A) to an interface unit (44) of the audio distribution unit (10), and a fourth conductor (26A(R2)) connects a drive-signal terminal of said second audio transducer (14A(R)) to a corresponding output terminal (30A(R)) of said second power amplifier (24A(R)), the audio signals being supplied by way of the first, second and fourth conductors and the at least one of power and data signals being transferred by way of the first and third conductors.

In another embodiment of the first aspect, the audio distribution unit (10) comprises first and second power amplifiers (24A(L),24A(R)) each connected to a respective one of two grounds (1,2) that are separated electrically from each other, a first conductor (26A(L1)) connects one drive-signal terminal of the first audio transducer (14A(L)) to a ground terminal of the first power amplifier (24A(L)), a second conductor (26A(L2)) connects the other drive-signal terminal of the first audio transducer (14A(L)) to an output terminal (30A(L)) of the first power amplifier (24A(L)), a third conductor (26A(R1)) connects one terminal of the second audio transducer (14A(R)) to a ground terminal of the second power amplifier (24A(R)), and a fourth conductor (26A(R2)) connects the other drive-signal terminal of the second audio transducer (14A(R)) to a corresponding output terminal (30A(R)) of the second power amplifier (24A(R)), the audio signals being supplied to the first audio transducer (14A(L)) by way of the first and second conductors, and to the second audio transducer (14A(R)) by way of the third and fourth conductors, and said at least one of power and data signals being transferred by way of the first (26A(L1)) and third (26A(R1)) conductors.

According to a second aspect of the invention, there is provided apparatus comprising an audio distribution unit having input means for audio signals from audio sources and output ports connected to at least one set of audio transducers. The set of audio transducers comprises at least a first audio transducer and a second audio transducer connected to a respective set of said output ports by a set of conductors comprising first, second, third and fourth conductors. The apparatus further comprises at least one remote unit associated with the set of audio transducers. The audio distribution unit has a first ground and a separate second ground. The first conductor and the

second conductor connect respective drive-signal terminals of the first audio transducer to the first ground and a line terminal of a first of the set of output ports, respectively, of the audio distribution unit. The third conductor and the fourth conductor connect respective drive signal terminals of the second audio transducer to the second ground and a line terminal of a second of the set of output ports, respectively, of the audio distribution unit. The remote unit is connected to the first ground and the second ground. The apparatus further comprises transferring means for transferring at least one of power and data signals between the audio distribution unit and the remote unit by way of a transmission path including the first ground and second ground.

Preferably, the or each remote unit is connected to the first ground and the second ground by the first conductor and third conductor, respectively.

The transferring means may comprise means for maintaining a potential difference between the first and second grounds, and the remote unit then may comprise a power extraction circuit connected to the first ground and second ground for extracting power for operation of components of the remote unit.

The apparatus may comprise a plurality of such sets of audio transducers connected by a corresponding plurality of sets of conductors and having a corresponding plurality of associated remote units. Each remote unit may then be connected to the first ground and second ground in the audio distribution unit by conductors of the same set of conductors that connect the associated audio transducers to the audio distribution unit. Alternatively, one or more of the remote units may be connected to the audio distribution unit by at least one of the conductors of a set connecting a different set of audio transducers to the audio distribution unit, i.e. not the set of audio transducers with which that remote unit is associated.

Where the apparatus comprises a plurality of audio transducer sets, the transferring means may include means at each remote unit for including an identifier in its transmitted data signals and means at the audio distribution unit for detecting the identifier and identifying therefrom the corresponding remote unit.

The or each remote unit may comprise modulator means for providing signals modulated in dependence upon data input thereto, and the audio

distribution unit then may have a corresponding demodulator means connected between the grounded conductors for detecting and demodulating such modulated signals. The audio distribution unit then may comprise control means, such as a microcomputer, responsive to the demodulated signals for controlling operation of the audio distribution unit.

The audio distribution unit also may have modulation means for transmitting onto the transmission path signals modulated according to data signals received from components of, or attached to, the audio distribution unit. The remote unit then may have a corresponding demodulator for detecting and demodulating such signals received via the transmission path from the audio distribution unit.

The remote unit and audio distribution unit may employ any suitable bandpass data transmission scheme, such as Frequency Shift Keying or Amplitude Shift Keying, for communicating said signals.

Preferably, the audio distribution unit comprises a preamplifier unit and an audio power amplifier unit for supplying audio signals from the preamplifier unit to the set of audio transducers, the audio power amplifier unit comprising first and second power amplifiers coupled to the first and second audio transducers, respectively, and having their ground terminals coupled to the first and second grounds, respectively. The first power amplifier then has its input connected directly to a corresponding first audio output port of the preamplifier unit and the second power amplifier has its input coupled to the corresponding second audio output port of the preamplifier unit by way of a coupling device arranged to permit a potential difference between the ground terminals of the second power amplifier and the preamplifier unit, respectively.

In one preferred embodiment, the first power amplifier has a ground terminal and an output terminal connected by said first and second conductors, respectively, to said one of the two audio transducers, the ground terminal being connected to said first ground, and an input terminal connected to a first audio output port of the preamplifier unit. The second power amplifier has a ground terminal and an output terminal connected by said third and fourth conductors, respectively, to said other of the two audio transducers, and an input terminal connected to an output of the coupling device, the coupling

device having its input connected to the second audio output port of the preamplifier unit, and the second power amplifier ground terminal being connected to said second ground.

The audio distribution unit may have a third ground separate from both the first ground and the second ground, the set of output ports comprise a third output port, the one set of audio transducers comprise a third audio transducer and the set of conductors further comprise a fifth conductor and a sixth conductor connecting drive terminals of the third audio transducer to ground and line terminals, respectively, of the third output port. The remote unit then may be connected also to the third ground, and the transferring means be connected to the reference, second and third grounds for transference of power to the remote unit via one pair of the three grounds and transference of the data signals via a different pair of the three grounds. Alternatively, signalling might be transferred via either or both of the channels.

The apparatus may comprise a second set of audio transducers connected to a corresponding second set of output ports of the audio distribution unit by a second set of first, second, third and fourth conductors and the audio distribution unit have a third ground separate from both the first ground and second ground, with a first audio transducer of the second set connected to the first ground and a second audio transducer of the second set connected to the third ground, a second remote unit being associated with the second set of audio transducers and connected to the audio distribution unit by a transmission path, conveniently different from the first transmission path. The transferring means then may be coupled to the third ground for transmission of either or both of power and signalling between the audio distribution unit and the second remote unit connected to the third ground and first ground.

Each remote unit may be connected to conductors connecting to the audio distribution unit the set of audio transducers with which it is co-located; or connected to conductors connecting a different set of audio transducers. In either case, signals to and from the remote unit will include an identifier identifying the location of the remote unit.

The apparatus may be provided with an intercom feature, whether the remote unit is connected to the audio distribution unit by a multiconductor cable or via the loudspeaker conductors. Thus, the remote unit may comprise voice circuitry for producing voice signals in response to a microphone and transmitting the voice signals to the audio distribution unit via the two grounds and means for adding to the signals at least one address of a remote unit, the audio distribution unit comprising means for detecting the voice signals and applying the detected voice signals to an input of the audio distribution unit, the audio distribution means comprising means for detecting the address and, in dependence thereon, directing the voice signals to one or more audio transducer sets other than that from which the voice signals originated.

According to a third aspect of the invention, there is provided apparatus comprising an audio distribution unit and a plurality of sets each of at least one audio transducer connected by a signal transmission path to the audio distribution unit, at least one of the sets of at least one audio transducer being remote from the audio distribution unit and having a remote unit associated therewith, the remote unit comprising voice circuitry for transmitting voice signals from a microphone via a transmission channel interconnecting the remote unit and the audio distribution unit, and means for adding to the signals at least one address corresponding to one of the sets of audio transducers, and the audio distribution unit comprises means for extracting the voice signals from the transmission channel and applying the extracted voice signals to an input of the audio distribution unit, and means for detecting the address and, in dependence thereon, directing the voice signals to one or more audio transducer sets other than that from which the voice signals originated.

The transmission channel may comprise conductors connected to the audio transducers, or separate conductors.

The audio distribution unit may have separate grounds, and the transmission channels be coupled between those grounds.

According to a fourth aspect of the invention, there is provided apparatus comprising an audio distribution unit having means for providing audio signals from at least one audio source controllable by infrared control signals, at least one audio transducer at a location remote from the audio

distribution unit and connected thereto by a signal transmission path, and a remote unit associated with the audio transducer and connected thereto by a transmission channel, the apparatus further comprising an infrared transmitter for transmitting said infrared control signals for controlling said audio source, and wherein the remote unit comprises a receiver for receiving, from an infrared remote control device, infrared signals corresponding to said infrared control signals, generating in response thereto corresponding source control signals, and transmitting the source control signals to the audio distribution unit by way said transmission channel, the audio distribution unit having means for detecting said source control signals and controlling the infrared transmitter in dependence thereupon to generate said infrared control signals.

In embodiments of any of these aspects of the invention, the audio distribution unit and the audio transducers may be supplied separately. Hence, according to a fifth aspect of the invention, there is provided an audio distribution unit for use as part of the apparatus of the first aspect, and having means for providing audio signals from audio sources, a first ground, a separate second ground, at least one set of output ports each having a line terminal and a ground terminal, such set of output ports including a first output port and a second output port having their respective ground terminals connected to the first ground and second ground, respectively, for connection to a first and a second of a corresponding set of audio transducers, and means for transferring by way of said first ground and said second ground, and said first and second output ports, at least one of power and data signals between said audio distribution unit and a remote unit associated with said set of audio transducers.

According to a sixth aspect of the invention, there is provided an audio distribution unit for use as part of apparatus according to the second aspect, namely with a plurality of sets each of at least one audio transducer connected by a signal transmission path to the audio distribution unit, at least one of the sets of at least one audio transducer being remote from the audio distribution unit and having a remote unit associated therewith, the remote unit comprising voice circuitry (102) for transmitting voice signals from a microphone via a transmission channel interconnecting the remote unit and the audio distribution

unit, and means for adding to the signals at least one address corresponding to one of the sets of audio transducers, said audio distribution unit comprising means for extracting the voice signals from the transmission channel, and means for detecting the address and, in dependence thereon, directing the voice signals to one or more audio transducer sets other than that from which the voice signals originated.

According to a seventh aspect of the invention, there is provided an audio distribution unit having means for providing audio signals from at least one audio source controllable by infrared control signals and configured for use with at least one audio transducer at a location remote from the audio distribution unit and connected thereto by a signal transmission path, and a remote unit associated with the audio transducer and connected thereto by a transmission channel, the remote unit comprising a receiver for receiving, from an infrared remote control device, infrared signals corresponding to said infrared control signals, generating in response thereto corresponding source control signals, and transmitting the source control signals to the audio distribution unit by way said transmission channel, the audio distribution unit having an infrared transmitter for transmitting said infrared control signals for controlling said audio source, and means for detecting said source control signals and controlling the infrared transmitter in dependence thereupon to generate said infrared control signals.

Various other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description, taken in conjunction with the accompanying drawings, of preferred embodiments of the invention, which are described by way of example only.

BRIEF DESCRIPTION OF DRAWINGS:

Figure 1 is a schematic diagram of an audio system comprising an audio distribution unit and several sets of loudspeakers, each set located in a different zone and having an associated remote unit;

Figure 2 is a more detailed block schematic diagram of a line interface unit of the audio distribution unit; and

Figure 3 is a more detailed block schematic diagram of the remote unit;

Figure 4 is a schematic circuit diagram of a power extraction circuit of the remote unit;

Figure 5 is a schematic circuit diagram of a microphone and a microphone interface of a first modification;

Figure 6 illustrates an alternative coupling device for coupling audio signals in the audio distribution unit;

Figure 7 illustrates modifications to parts of the audio system of Figure 1 to provide different grounds for different sets of loudspeakers;

Figure 8 illustrates a modification which uses three grounds to provide two transmission channels to a set of three loudspeakers, one channel for transmitting power and the other for signalling;

Figure 9 illustrates a modified interface unit for the modified apparatus of Figure 8;

Figure 10 illustrates modifications to a remote unit for use with the modified apparatus of Figure 8; and

Figure 11 illustrates a further embodiment of the invention in which two speakers and a remote control in a zone are connected to the audio unit by four conductors, one being a common ground conductor.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figure 1, a multi-zone audio system comprises an audio distribution unit 10 which has several stereo inputs. Figure 1 shows inputs 11 for a compact disc player (CD), a radio tuner (TUNER) and a tape unit (TAPE), and an auxiliary input (AUX). Usually, there would be additional inputs for other sources, such as a video cassette recorder, digital video disc player (DVD) and so on. The audio distribution unit 10 has four sets of outport ports 12A, 12B, 12C and 12D connected to four sets of audio transducers, specifically loudspeakers, located in four zones A, B, C and D, respectively. Each set of the output ports comprises a stereo pair of output ports 12A(L), 12A(R),...12D(L), 12D(R). For clarity, only two sets of loudspeakers, namely loudspeakers 14A(R) and 14A(L) and 14D(R) and 14D(L) are shown. The letters (R) and (L) designate RIGHT and LEFT stereo channels, respectively, and the letters A and D designate the zones in which the sets of loudspeakers are

located. Although Figure 1 shows only two loudspeakers in each set, it could comprise more than two loudspeakers, such as might be used in a "surround sound" or home theater system.

The audio distribution unit 10 comprises a preamplifier unit 16 which includes the usual preamplifier and a switching matrix allowing some or all of the inputs 11 to be connected simultaneously to respective sets of the loudspeakers. The preamplifier unit 16 also has a data input port 18 for receiving data signals to control operation of the audio distribution unit 10, to vary, for example, volume, bass, treble and balance, and to operate the switching matrix to make or alter input/source selections. The construction of such a preamplifier unit 16 is known to persons skilled in this art, so it will not be described in detail here.

The audio distribution unit 10 also comprises four identical stereo power amplifier units (22A...22D), one for each set of loudspeakers, connected to the four sets of stereo output ports 12A, 12B, 12C and 12D, respectively.

The loudspeakers 14A(L) and 14A(R) have the usual "RED" and "BLACK" drive signal input terminals, indicating the polarity of the windings so that the pair of loudspeakers can be connected to the associated power amplifiers with the same polarity, thereby ensuring proper stereo reproduction. For convenience of illustration, only two of the stereo power amplifier units, 22A and 22D, are shown, and only one unit, 22A, will be described. Stereo power amplifier unit 22A comprises two identical audio power amplifiers 24A(L) and 24A(R), connected to loudspeakers 14A(L) and 14A(R), respectively, by a set of loudspeaker cables comprising first and second conductors 26A(L1) and 26A(L2) connecting the BLACK and RED terminals of LEFT loudspeaker 14A(L) to the ground terminal and line terminal 30A(L), respectively, of amplifier 24A(L) via output port 12A(L) and third and fourth conductors 26A(R1) and 26A(R2) connecting BLACK and RED terminals of the RIGHT loudspeaker 14A(R) to the ground terminal and line output terminal 30A(R) respectively, of amplifier 24A(R) via output port 12A(R). LEFT stereo channel power amplifier 24A(L) has its input connected to LEFT channel line output terminal 20A(L) of preamplifier unit 16, and its power supply terminals connected to a first power supply 28 which supplies voltages V_1^+ and V_1^-, with

amplitude of, say, +35 volts and -35 volts, respectively, relative to a first, reference ground designated as ground "1". The GROUND terminal of LEFT power amplifier 24A(L) is connected to first ground "1". The preamplifier unit 16 is shown grounded to ground 1 and supplied with power at ± 15 volts, conveniently derived from power supply 28 by means of a suitable regulator circuit (not shown).

The RIGHT channel power amplifier 24A(R) is powered by supply voltages $V2^+$ and $V2^-$, also, say, +35 volts and -35 volts, respectively, derived from a second power supply 30, which supplies voltages V_2^+ and V_2^- relative to a second ground designated as ground "2". The GROUND terminal of power amplifier 24A(R) is connected to second ground "2". Hence, the BLACK terminals of loudspeaker 14A(L) and 14A(R) are connected to first ground 1 and second ground 2, respectively.

The signal input 21A(L) of power amplifier 24A(L) is connected directly to the LEFT channel output terminal 20A(L) of the preamplifier unit 16. The signal input 21A(R) of power amplifier 24A(R), however, is connected to the corresponding RIGHT channel output terminal 20A(R) of preamplifier unit 16 by way of a coupling device, specifically, a differential amplifier 32A which has its output terminal connected to the input 21A(R) of RIGHT channel power amplifier 24A(R), its non-inverting input terminal (+) connected to the RIGHT channel output terminal 20A(R) of the preamplifier unit 16, and its inverting input terminal (-) connected to first ground 1. The GROUND terminal of differential amplifier 32A is connected to second ground 2.

The differential amplifier 32A will maintain the difference between its output and ground 2 so that it is the same as the difference between its non-inverting and inverting inputs. The signal applied to the input 21A(R) of power amplifier 24A(R), relative to first ground 1, will be the sum of the RIGHT channel audio signal from preamplifier terminal 20A(R) and any voltage difference between first ground 1 and second ground 2. Because the output 30A(R) of power amplifier 24A(R) is referenced to second ground 2, however, only the audio signal will appear on the RED and BLACK loudspeaker conductors 26A(R1) and 26A(R2), as a differential mode signal. Any variations in the voltage between first ground 1 and second ground 2, however, will

appear on both conductors 26A(R1) and 26A(R2), i.e. as common mode signals, and hence will not be "seen" by loudspeaker 14A(R). Accordingly, grounds 1 and 2 and the two loudspeaker ground (BLACK) conductors 26A(L1) and 26A(R1) may be used as a transmission path or channel for "common mode" transmission of power and signalling, as will be described later.

It should be appreciated that the connections between the loudspeaker cable conductors and the RED and BLACK terminals could be transposed, i.e. the RED terminals of the loudspeakers 14A(L) and 14A(R) could be connected to the grounds 1 and 2, instead of the BLACK terminals.

A remote control unit 34A for controlling the loudspeakers in zone A is connected across the conductors 26A(L1) and 26A(R1) and hence between the respective BLACK terminals of the loudspeakers 14A(R) and 14A(L).

Power amplifier unit 22D is identical to power amplifier unit 22A and so will not be described in detail. In Figure 1, its components have the same reference numbers as the corresponding components in power amplifier 24A, but with the zone suffix "D".

The system includes means for transferring power and signalling between the audio distribution unit 10 and the remote unit 34A via the above-mentioned transmission path. At the audio distribution unit 10, the transferring means includes a microcontroller 40, with its own 5 volt power supply 42 referenced to first ground 1, and a line interface unit 44 supplied by power supply 28 and referenced to first ground 1. The line interface unit 44 is connected to the microcontroller 40 by a first link 46 for data signals (RX) received from the remote control units 34A to 34D and a second link 48 for data signals (TX) from the microcontroller 40 which are to be transmitted to the remote control units 34A to 34D. The output of line interface unit 44 is connected to second ground 2 of power supply 30 and maintains second ground 2 at a potential difference of about 20 volts d.c. relative to ground 1. It should be noted, therefore, that second ground 2 and voltages V_2^+ and V_2^- "float" relative to ground 1 and voltages V_1^+ and V_1^- with a potential

difference of about 20 volts d.c., subject to variations due to modulation signals, as will be described later.

In operation, the line interface unit 44 maintains this potential difference of about 20 volts d.c. between the first and third conductors 26A(L1) and 26A(R1) and likewise between the corresponding "grounded" conductors of the other loudspeaker sets in zones B, C and D. Because the remote control units are connected between these "grounded" conductors, they are able to extract power at 20 volts d.c. from the interface unit 44. At each of the remote control units 34A to 34D, the afore-mentioned transferring means includes means for transmitting signals to the microcontroller 40 via the signal transmission channel defined by the pair of "grounded" conductors to which it is connected, specifically by applying modulated signals to them. Also, the line interface unit 44 can transmit modulated signals to the remote units via the transmission channels.

Referring to Figure 2, a suitable line interface unit 44 comprises a transconductance amplifier and D.C. voltage source unit 50 formed by an amplifier 52 which is supplied with voltages V_1^+ and V_1^- from power supply 28 (Figure 1) and has a non-inverting input (+) coupled to a 20 volt d.c. source 54 by a resistor 56. The source 54 has its negative terminal connected to first ground 1. The inverting input (-) of amplifier 52 is connected to its output by a first feedback loop comprising a resistor 58. An output resistor 60 connects the output of the amplifier 52 to ground 2. A second feedback loop is formed by a capacitor 62 and a resistor 64 connected in series between the second ground 2 and the non-inverting input (+) of amplifier 52. In operation, and when quiescent unit 50 maintains a potential difference of about 20 volts d.c. between grounds 1 and 2.

An output terminal of a modulator 66 is connected to the inverting input (-) of amplifier 52 by a second capacitor 68 and resistor 70, in series. The input of the modulator 66 is connected to the link 48 to receive digital data signals (TX) from the microcontroller 40 (Figure 1). The modulator 66 may use Frequency Shift Keying (FSK), Amplitude Shift Keying (ASK), or any other type of modulation suitable for digital data transmission. When half duplex FSK is used, suitable mark and space carrier frequencies might be 100 kHz for "1" and

90 kHz for a zero. Full duplex FSK could be implemented using two additional frequencies.

A demodulator 72 has its input connected to the output of the transconductance amplifier unit 50 (and hence to second ground 2), and its output connected to the link 46 to pass demodulated digital data signals (RX) received on second ground 2 to the microcontroller 40 (Figure 1).

In use, signals received on link 48 from the microcontroller 40, for example to give the status of the controls of audio distribution unit 10, are modulated by modulator 66 and supplied to amplifier 52, which transmits them onto the second ground 2 and hence broadcasts them to all of the remote control units 34A-34D. Each remote control unit has a unique address assigned during a set-up procedure and mapped to the corresponding zone by suitable entries in the memory of the microcontroller 40. The microcontroller 40 will include in each broadcast signal the address of the remote control unit 34A-34D for which the signal is intended. The remote control unit for which the signal is intended will detect its own address in the signal, process the signal accordingly, using known techniques, and provide a suitable response, such as displaying a setting for one of the parameters of the audio distribution unit 10. Conversely, signals applied to one of the transmission channels by one of the remote control units 34A-34D, when received in the interface unit 44, will be demodulated by demodulator 72 and transmitted via link 46 to the microcontroller 40. All of the remote control units 34A-34D are effectively connected in parallel between first grounds 1 and second ground 2, and all transmitters in both the interface unit 44 and, as will be described later, the remote control units, have low output impedances, of the order of 100 ohms. Consequently, as soon as one of them transmits a signal, all of the others will receive it. Each of the remote control units 34A-34D is arranged to inhibit operation of its own transmitter while its own receiver is receiving a signal, as is common in transceivers. This same feature will operate to inhibit the transmitters of all other remote control units as soon as one of them begins to transmit, thereby avoiding "collisions" if two users using different ones of the remote control units 34A-34D attempt to control the audio distribution unit 10 at the same time.

The remote control units 34A-34D are identical, so only one will be described. As shown in Figure 3, a suitable remote control unit 34A comprises a power extraction circuit 76 connected across terminals 77 and 79 which, in use, are connected to the BLACK terminals of the LEFT and RIGHT loudspeakers, respectively, and hence across "grounded" first and third conductors 26A(L1) and 26A(R1), respectively. The power extraction circuit 76 supplies the various components of the remote control unit 34A, including a second microcontroller 84, at a voltage of 5 volts d.c., and has a "backlight" output 85 which supplies the backlight of a display 86. (For clarity, the supply connections to second microcontroller 84 and display 86 only are shown). The backlight supply is turned on and off by the microcontroller 84 by way of a control signal line 87 connecting a backlight on/off output of the microcontroller 84 to the power extraction circuit 76. The connection of terminal 77 to the BLACK terminal of the left loudspeaker 14A(L), i.e. to first conductor 26A(L1) and indirectly to ground 1, constitutes the ground for the remote control unit 34A.

The third conductor 26A(R1) (BLACK terminal) of the RIGHT loudspeaker 14A(R) is connected via an isolating capacitor 78 to an input of a receiver amplifier 80, the output of which is connected to the input of a demodulator 82, which operates conversely to the modulator 66 in the interface unit 44 to demodulate received signals. The output of the demodulator 82 is coupled to an input of the second microcontroller 84 which controls display 86. An input device 88, for example a keypad having a set of pushbuttons, or a touch-screen overlay on display 86, is coupled to a second input of the microcontroller 84 for manual inputting of instructions or data by a user.

An output of microcontroller 84 is connected to an input of a modulator 90 which corresponds to the demodulator 72 in interface unit 44. The output of the modulator 90 is connected to an input of a transmitter amplifier 94, the output of which is coupled to the third conductor 26A(R1), and hence the second ground 2, by way of a (100Ω) termination resistor 96 which connects the output of the transmitter amplifier 94 to the isolating capacitor 78.

The power extraction circuit 76, microcontroller 84, modulator 90, demodulator 82, and amplifiers 80 and 94 constitute parts of the afore-

mentioned transferring means, the other parts being in the audio distribution unit 10.

The power extraction circuit 76, shown in detail in Figure 4, comprises a first transistor 110 with its collector connected to third conductor 26A(R1) and its emitter coupled to first conductor 26A(L1) by way of a capacitor 112. A resistor 114 and capacitor 116 are connected in series between the transistor emitter and first conductor 26A(L1). The capacitors 112 and 116 and resistor 114 form a filter to remove digital noise. A 5.6 volt Zener diode 118 and feed resistor 120 are connected in series between the conductors 26A(R1) and 26A(L1). The cathode of the Zener diode 118 is connected to the base of transistor 110 and, by way of a smoothing capacitor 122, to the local ground, i.e. conductor 26A(L1). The transistor 110 acts as a voltage follower with a voltage drop equivalent to that of one diode, and the 5 volt supply for the various components of the remote control unit is taken from the junction between resistor 114 and capacitor 116, on line 124.

The backlight supply circuitry comprises a second transistor 126 connected as a constant current source, with its emitter connected by way of a resistor 128 to conductor 26A(R1) and its collector connected to the backlight output 85 and hence to display 86 (Figure 3). Transistor 126 is biased by means of a pair of diodes 132 and 134 connected in series between conductor 26A(R1) and the base of transistor 126. A second smoothing capacitor 136 is connected in parallel with the diodes 132 and 134 to smooth switching transients.

The backlight supply transistor 126 is turned on and off by means of a switching transistor 138 which has its emitter grounded (to the local ground - conductor 26A(L1)), its collector coupled by way of a resistor 140 to the cathode of diode 134 and its base coupled by way of a resistor 142 and control line 87 to the backlight on/off output of the microcontroller 84 (Figure 3). The microcontroller 84 is programmed so that, as soon as the user operates the input device 88 (Figure 3), for example presses a key, it turns on transistor 138 which turns on the backlight current.

The microcontroller 84 stores the address for the remote unit in the system. When a user presses a key, the microcontroller 84 extracts the

address of its own remote unit and includes it in a data signal, which then is transmitted to the microcontroller 40 in the audio distribution unit 10, allowing the latter to determine the source of the data signal. The microcontroller 40 will control the audio distribution unit 10 according to the content of the data signals received from the remote unit 34A and will communicate to the transmitting remote unit 34A such data signals as are appropriate.

Referring again to Figure 3, when the system is in use, signals received from the interface unit 44 via conductors 26A(R1) and 26A(L1) are amplified by receiver amplifier 80, which also provides bandpass filtering to limit the signal to the transmit bandwidth of the modulator 66 (Figure 2), demodulated by demodulator 82 and supplied to the microcontroller 84, which deciphers the signals and controls the display 86 accordingly. Conversely, when a user inputs information or commands by way of input device 88, corresponding digital data signals from the microcontroller 84 are modulated by modulator 90, amplified by transmitter amplifier 94 and applied to the conductor 26A(R1).

As mentioned previously, each of the remote control units 34A-34D has the ability to turn off its own transmitter when its receiver is receiving a data signal. Thus, the microcontroller 84 continuously monitors the output of the demodulator 82 and compares it with the input to the modulator 90. If they are not the same, a "collision" is assumed. If the microcontroller 84 is not driving the modulator 90 and transmitter amplifier 94, and the demodulator 82 is outputting a data signal (the demodulator output has a data valid line and a data line), the microcontroller 84 inhibits its own transmissions. In a similar manner, in the audio distribution unit 10 (Figure 1), the microcontroller 40 will monitor RX data line 46 and inhibit its own transmissions as required. In essence, the arrangement is like a network, with the audio distribution unit 10 acting as a hub to which the remote control units 34A-34D are connected by their respective transmission channels formed by pairs of loudspeaker conductors. When any network element is transmitting, the other elements wait until the transmission ends before seizing the opportunity to transmit themselves. The network analogy also applies to the use of unique addresses for the remote units, enabling selective communications using known network signalling techniques.

Various modifications and substitutions may be made to the above-described embodiment without departing from the scope of the present invention. Thus, it is envisaged that a full wave rectifier could be interposed between the conductors 26A(R1) and 26A(L1) and the power extraction circuit 76 of each of the remote control units 34A-34D, so that the power supply to the remote control units would be independent of the polarity of the potential difference on the corresponding transmission channel. This would, of course, require the use of a polarity-insensitive signalling scheme, such as FSK or ASK.

It is also envisaged that the system could be modified to add an intercom feature, in which case the signals transmitted between the audio distribution unit 10 and the remote unit(s) 34A-34D would include baseband voice signals as well as the data signals, the latter being above baseband.

Figures 2 and 3 illustrate, in dashed lines, a modification to the interface unit 44 two alternative modifications to the remote unit 34A, which would permit intercom use, it being understood that similar modifications would be made to the other remote units 34B-34D. As shown in dashed lines in Figure 3, remote control unit 34A could have a microphone 96A connected by way of a microphone amplifier 98A and intercom ON/OFF switch 99A (conveniently controlled by microcontroller 84) directly to the conductor 26A(R1) allowing transmission of voice signals via the conductors 26A(L1) and 26A(R1) to the interface unit 44. As shown in broken lines in Figure 2, the interface unit 44 could then have a capacitor 104 or other suitable voice circuitry for extracting the voice signal and supplying it to an extra input (not shown), such as the microphone input MIC, of preamplifier unit 16, by way of a suitable connection 100 shown in broken lines in Figure 1.

Alternatively, and preferably, the voice signal could be transmitted by modulating the "backlight" current of the power extraction unit 76. Suitable additional circuitry for doing so is shown in chain-link lines in Figures 3 and 4. Thus, referring to Figure 3, microphone 96A' is connected to microphone amplifier and interface circuit 102, the output of which is connected to an input of the power extraction circuit 76. As shown in Figure 4, within the power extraction circuit 76, the output of the microphone amplifier and interface unit 102 (Figure 3) is coupled to the base of transistor 126 by way of an additional

capacitor 144 and an additional resistor 146 connected in series. An additional resistor 148 is inserted in series with the base of transistor 126. Resistors 146 and 148 are equal in value, suitably 100 ohms, so about one half of the voice signal is applied to the base of the transistor 126. The voice signal modulates the backlight current on the collector of transistor 126, which typically has a quiescent value of about 100 mA. The backlight supply circuitry of power extraction circuit 76 is a constant current source. Consequently, variations in the backlight current will appear as changes in the voltage across first ground 1 and second ground 2 in the audio distribution unit 10. When the user speaks, the backlight current will vary in proportion to the output of microphone amplifier and interface unit 102.

It is also envisaged that the voice signal could be used to modulate the total current consumed by the remote unit.

The system may be capable of paging, in which case the message is broadcast to all of the other zones, or directed messaging, in which case the message is sent to one or more zones selected by the user. A user wishing to send, for example, broadcast voice signals, will press a corresponding key or symbol on the input device 88. The microcontroller 84 will respond by turning on the backlight (if it is not already on), detecting the "intercom" selection, generating a corresponding data signal including the address of the local remote unit 34A and transmitting it to microcontroller 40 in the audio distribution unit 10, at the same time operating switch 99A to enable voice transmissions. On receipt of the "intercom" data signal on line 46, the microcontroller 40, which is suitably programmed, will detect the address of remote unit 34A only and issue a control signal to the preamplifier unit 16 to cause the switching matrix to route the voice signals from the MIC input 18 to the loudspeaker sets in all of the other zones B, C and D, muting or reducing their existing signals as appropriate. When, subsequently, the user speaks into the microphone 96A, the voice signal will be broadcast to the loudspeakers in the other zones B, C and D. It will be appreciated that, to avoid feedback problems, the voice signal will not be transmitted to the audio transducer set in the zone from which the voice signal originated.

If the user wished to direct the message to a particular zone, he would first select the "intercom" mode and then identify the reception zone using the input device 88. The microcontroller 84, which would have all of the zone addresses stored in memory, would select the appropriate address and include it in the message, as a "recipient" address, together with the "sender" zone address. At the audio distribution unit 10, the microcontroller 40 would detect the recipient zone address and control the switching matrix so as to direct the message to the one zone only.

It will be appreciated that this intercom system could also be modified to allow the user to input several recipient addresses and send the same voice message to several selected zones, but not broadcast to all of them.

As shown in Figure 5, a suitable microphone amplifier and interface unit 102 comprises an amplifier 150 having its non-inverting input connected to the microphone 96A' by way of an ON/OFF switch 152 and a blocking capacitor 154 in series. The switch 152 may be a CMOS analog switching device or other suitable device controlled by the microcontroller 84 by way of line 156. The poles of the switch 152 are connected to local ground by resistors 158 and 160, respectively. As depicted in Figure 5, the microphone 96A' is an electret microphone comprising an internal field effect transistor (not shown) connected between the 5 volt supply and, by way of a bias resistor 162, local ground. The inverting input of amplifier 150 is connected to local ground by way of a resistor 164 and, by way of a feedback resistor 166, to the output of amplifier 150, which output is connected to the capacitor 144 in power extraction unit 76 (Figure 4).

In use, the user will select the intercom function by means of the input device 88. The microcontroller 84 will respond by turning on the backlight current (if it is not already on), closing normally-open switch 152, and, as before, transmitting data signals to select the loudspeaker sets to receive the voice signals. When the user speaks into the microphone 96A', the amplified voice signal will modulate the current flowing through constant current source transistor 126 (Figure 4). At voice frequencies, the constant current flows through a substantially constant impedance, i.e. the output impedance of

interface unit 44. As a result the potential difference across the conductors 26A(R1) and 26A(L1) will be modulated with the voice signal.

As before, at the interface unit 44, a capacitor 104 connected between the input of the demodulator 72 and the line 100 will extract the voice signal and supply it to the appropriate input 18 of the preamplifier unit 16.

It is envisaged that the intercom arrangement could be used with a multiconductor system, the transmission channel via which the voice signals are transmitted being defined by conductors other than those used to transmit the audio signals to the audio transducers.

Where a zone is equipped with a set of more than two loudspeakers, with a correspondingly greater number of "ground" wires, any two of the ground wires could be selected to form the transmission channel, providing that they were connected to the separate first ground 1 and second ground 2, so that the signalling was common mode with respect to the power amplifiers and loudspeakers and did not interfere with the audio signals.

For example, if there were four loudspeakers in a particular zone, two with their respective "ground" conductors connected to first ground 1 and two with their respectively "ground" conductor connected to second ground 2, the remote unit could be connected between either one of the first ground 1 conductors and either one of the second ground 2 conductors.

It is also envisaged that the audio distribution unit 10 could have at least a third ground 3, isolated from both first ground 1 and second ground 2, and the "ground" conductors of one or more of the audio transducer sets could be connected between the first ground 1 and the third ground 3, thereby forming a separate transmission channel and providing better segregation between signals from the different remote units. Modifications to do so are illustrated in Figure 7 which shows a modified power amplifier unit 22B and the loudspeakers of zone B, together with an additional interface unit 44/2 and additional power supply 29 in the audio distribution unit 10. Other components of the system, i.e. for zones A, C and D, will be as shown in Figure 1.

As shown in Figure 7, the third power supply 29 provides voltages V_3^+ and V_3^-, say +35 volts and -35 volts, relative to third ground 3,

conveniently, but not necessarily, the same as that between first ground 1 and second ground 2. The second interface unit 44/2, which is similar in construction to first interface unit 44, is connected between the microcontroller 40 and third ground 3, and maintains third ground 3 at a predetermined voltage relative to first ground 1. It also may have a capacitor (not shown) for coupling voice signals via line 100' to a microphone input, or other suitable audio input, of the preamplifier unit 16 if the intercom feature is provided. Data links 46/2 and 48/2 couple received and transmitted data signals (RX2, TX2), respectively, between the microcontroller 40 and the third ground 3. The power amplifier unit 22B for zone B is generally similar to the power amplifier unit 22A of Figure 1 and is connected to zone B loudspeakers 14B(L) and 14B(R) in a similar manner. It differs, however, in that the "ground" terminals of differential amplifier 32B and power amplifier 24B(R), and hence the "grounded" loudspeaker conductor 26B(R1), i.e. connected to the BLACK terminal of loudspeaker 14B(R), are connected to the third ground 3. Consequently, the transmission channel for zone B is defined by conductors 26B(L1) and 26B(R3) which connect the zone B remote unit 34B to first ground 1 and third ground 3, respectively.

As before, the differential amplifier 32B ensures that the audio signal from preamplifier output 20B(R) appears as a differential signal across the conductors 26B(R1) and 26B(R2) while variations in the potential difference between ground 1 and ground 3 appear on both of these conductors, i.e. in common mode, and so are not "seen" by the loudspeaker 14B(R).

Figure 8 illustrates how, when the set of audio transducers in a zone includes a third audio transducer, it would be possible to provide a third ground in the audio distribution unit 10 and connect the "ground" conductor of the third audio transducer to the third ground.

Thus, Figure 8 shows a modified power amplifier unit 22A' connected to three loudspeakers 14A(L), 14A(R) and 14A(C) in zone A. The power amplifier unit 22A' comprises three power amplifiers 24A(L), 24A(R) and 24A(C) connected to the LEFT, RIGHT and CENTRE channel loudspeakers 14A(L), 14A(R) and 14A(C), respectively, by a set of six conductors 26A(L1) and 26A(L2), 26A(R1) and 26A(R2), and 26A(C1) and 26A(C2) connected to

output ports 12A(L), 12(R) and 12(C). The ground terminals of power amplifiers 24A(L), 24A(R) and 24A(C) are connected to grounds 1, 2 and 3, respectively. The power amplifiers 24A(R) and 24A(C) are connected by differential amplifiers 32A(1) and 32A(2), respectively, to the corresponding outputs of preamplifier unit 16 and are supplied from power supplies 30 and 29, respectively. The audio distribution unit 10 has a modified interface unit 44' which has two outputs, one connected to ground 2 and the other connected to ground 3. A suitably modified remote unit 34A' is connected to all three ground conductors 26A(L1), 26A(R1) and 26A(C1)

As shown in more detail in Figure 9, the modified interface unit 44' supplies power to the modified remote unit 34A' via grounds 1 and 3 and signalling via grounds 1 and 2. Thus, the modified interface unit 44' comprises a modulator 66 and demodulator 72 connected between data lines 48 and 46, respectively, and an amplifier 52. Amplifier 52 has its non-inverting input connected to the output of modulator 66 and its output connected to second ground 2 by a resistor 60. The input of demodulator 72 is connected to second ground 2. A feedback resistor 64 interconnects the output and inverting input of amplifier 52 and the inverting input is coupled to first ground 1 by resistor 56. The modulator 66, demodulator 72 and amplifier 52 operate in a similar manner to those shown in Figure 2 to communicate signals between microcontroller 40 and remote unit 34A' via the transmission channel defined by grounds 1 and 2 and the loudspeaker conductors 26A(L1) and 26A(R1).

Power is supplied to the remote unit 34A' via first ground 1 and third ground 3 and conductors 26A (L1) and 26A(C1) by a separate power supply 68 which has its negative pole coupled to first ground 1 and its positive pole coupled to third ground 3 by way of a current limiting resistor 55.

Figure 10 illustrates corresponding modifications to the remote unit 34A'. In particular, the voltage regulator comprises transistor 110, Zener diode 118, capacitors 122 and 112 and resistor 120, as in the voltage regulator of Figure 4, but without the additional smoothing capacitor 116 and resistor 114. The backlight circuitry is not shown in Figure 10 but would be similar to that shown in Figure 4.

The receiver amplifier 80 and transmitter amplifier 94 have their ground terminals coupled to first ground 1 via conductor 26A(L1). The input of receiver amplifier 80 is connected to second ground 2 via conductor 26A(R1) and the output of transmitter amplifier 94 is connected by way of resistor 96 to second ground 2. Other components of remote unit 34A' will be configured in a similar manner to those of remote unit 34A (Figure 3).

With such an arrangement, the transmission channel formed by conductors 26A(L1) and 26A(C1), between first ground 1 and third ground 3, is used to transfer power from the audio distribution unit 10 to the remote unit 34A' and the other transmission channel defined between conductors 26A(L1) and 26A(R1), first ground 1 and second ground 2, is used to transfer signals between the audio distribution unit 10 and the remote unit 34A'.

It should be appreciated that the intercom arrangement described as a modification with reference to Figures 1 to 5 could be adapted for use with the embodiment of Figure 8.

It is also envisaged that, in any of the foregoing embodiments, each remote unit could provide an interface for an infrared remote control device. As illustrated in broken lines in Figure 3, an infrared receiver 106, of the kind used in remote-controlled audio or video equipment, for receiving infrared signals transmitted by a separate infrared remote control device 107, may be coupled to the microcontroller 84 of remote unit 34A. The microcontroller 84 then would be programmed to transmit corresponding signals onto the signal transmission channel. At the audio distribution unit 10, the "infrared" data signals (or source control signals) would be demodulated and detected by the interface unit 44 along with other data signals from the remote units 34A-34D and passed to the microcontroller 40, which would supply corresponding source control signals to an infrared transmitter 101 (shown in broken lines in Figure 1) for communicating with one or more of the various source components. In order to differentiate the source control or "infrared" data signals from other data signals, the microcontroller 84 in the remote unit would add an identifier to the source control signal, for example, several control bits. The microcontroller 40 would detect the infrared identifier in the received data signal RX and control the infrared transmitter 101 to generate a corresponding

infrared control signal and broadcast it to the infrared receiver(s) on the front(s) of the source unit(s). It should be appreciated that the infrared signals could substitute for, or supplement, the other data signals.

Most infrared remote controls use ASK modulation. Consequently, where the remote unit is equipped with such an infrared receiver, the modulator could use ASK to transmit the signals from the infrared remote control device 107 for controlling the source unit (CD, tape, etc.) and use FSK to transmit the data signals for controlling operation of the audio distribution unit. The same demodulator could be used for both FSK and ASK. When the microcontroller 40 detected that the received signal was ASK modulated, it would pass it directly to the afore-mentioned infrared transmitter 101. If it detected that the signal was FSK modulated, however, the microcontroller 40 would determine the content of the signal and process it accordingly.

It should be appreciated that the infrared signals passed between the infrared remote control device 107 and the infrared receiver 106 need not be identical to the infrared control signals passed between the infrared transmitter 101 and the audio source unit(s), so long as they convey the appropriate information. It would be convenient, of course, if they were substantially identical.

Various other modifications are envisaged. Thus, one or more of the differential amplifiers 32A - 32D which allow the required referencing of the signal from terminal 20A(R) to the second ground 2 could be replaced by an isolation amplifier 32A′ which, as shown in Figure 6, would be connected in a similar manner to the differential amplifier 32A (Figure 1) but would provide electrical isolation between its inputs and outputs, hence providing better common mode rejection. Suitable isolation amplifiers may use optical, magnetic, capacitive, or other suitable forms of isolation. It is also envisaged that a transformer could be used instead of the differential amplifier.

Where it is desired to use a larger potential difference than can be tolerated by the differential amplifier 32A, a capacitor could be interposed between the input of the differential amplifier 32A and the preamplifier unit 16.

If it is required to transmit power only, the differential amplifier 32A could be replaced by a suitable capacitor connected directly between the

preamplifier output terminal 20A(R) and the input of power amplifier 24A(R). In the embodiment of Figure 8, therefore, the second differential amplifier 32A(2) could be replaced by a suitable capacitor connected directly between the preamplifier output 20A(C) and the input of power amplifier 24A(C).

It would be possible for the microcontrollers 40 and 84 to perform the required modulation, in which case modulators 66 (Figure 2) and 90 (Figure 3) could be omitted. It is also envisaged that the power amplifier units 24A(L)...24D(R) could be duplicate channels of a multi-channel power amplifier unit. The power amplifier units 24A(L)...24D(R), the interface unit 44, the microcontroller 40, and the remote control units 34A-34D could be supplied to a customer without the preamplifier unit 16, for addition to an existing preamplifier unit capable of external control by microcontroller 40 or the like. The microcontroller 40 also could be omitted if the preamplifier unit 16 already had a microcontroller capable of interfacing with the interface unit 44.

Although the above-described embodiments transmit both power and signalling between the audio distribution unit 10 and the remote control units 34A-34D, the invention embraces systems which transmit power only, or signalling only. The appropriate components could then be omitted.

Although a four-zone audio system has been described, it will be appreciated that more zones could be added simply by adding loudspeaker sets and duplicating the power amplifier units; or fewer zones served with correspondingly fewer power amplifier units and loudspeaker sets. Appropriate modifications would, of course, be made to other components, such as the switching matrix and the programming of the microcontrollers 40 and 84.

It should be appreciated that, although an audio system has been described, specifically, the invention is applicable to audio-video systems, such as home theatre systems, which have sets of several loudspeakers in different zones. In such a case, the audio distribution unit 10 could be combined with a video distribution unit which itself might have several sources and a suitable switching matrix. The video sources also might be distributed. The same microcontroller might then control the audio and video distribution.

It should be noted that more than one remote control unit could be mapped to the same zone, for example a large room.

It should also be noted that a particular remote unit could be physically associated (co-located) with the loudspeakers of one zone, and associated logically by having an address linked to that zone by the microcontroller 40, yet be connected to the ground conductors of loudspeakers in a different zone.

For example, if two sets of audio transducers were located in adjacent rooms, the conductors from both sets of audio transducers might follow a common path back to the audio distribution unit, perhaps initially within a wall shared by the two rooms. In such a case, it might be convenient for both remote units to be connected to the same pair of grounded conductors and share the same transmission channel. The microcontroller 40 would be able to discriminate between their signals because each remote unit would include its own address with any signals it transmitted and detect its own address in the broadcast signals it received.

Although, in the above-described embodiments, each remote unit is connected to the loudspeaker terminals, each remote unit could be connected to the loudspeaker conductors anywhere along their length, or even be connected to the audio distribution unit by a pair of conductors of a multiconductor cable, which were connected to the two grounds.

It is also envisaged that any of the foregoing embodiments of the invention could be modified so that two speakers and a remote unit in a zone shared four conductors, one of which connected the "ground" terminals of the remote unit and speakers to a common ground of the associated power amplifiers. Such an arrangement will now be described with reference to Figure 11. The system shown in Figure 11 is similar to that shown in Figure 1 and corresponding components have the same reference number. The system of Figure 11 differs from that of Figure 1, however, as follows: (i) the power amplifiers 24A(L),24A(R),...,24D(L),24D(R) share the same ground 1; (ii) the input terminals 21A(R),...,21D(R) of the RIGHT channel power amplifiers 24A(R),...,24D(R), respectively, are connected directly to output ports 20A(R),...,20D(R), respectively, of the preamplifier unit16; (iii) the second power supply unit 30 and ground 2 are omitted; (iv) both loudspeakers 14A(L) and 14A(R) have their BLACK terminals connected in common to the first conductor 26A(L1) and thereby to ground 1; (v) the terminal of remote unit

34A which, in the system of Figure 1, would have been connected to the BLACK terminal of speaker 14A(R) is connected directly to the interface unit 44 by a conductor 26A(R1)'; (vi) in zone D, both loudspeakers 14D(L) and 14D(R) have their BLACK terminals connected in common to the conductor 26D(L1) and thereby to ground 1; (vii) the terminal of remote unit 34D which, in the system of Figure 1, would have been connected to the BLACK terminal of speaker 14D(R) is connected directly to the interface unit 44 by a conductor 26D(R1)'. At the interface unit 44, the two conductors 26A(R1)' and 26D(R1)' are connected in common. The primes signify that, in a practical system, the conductors 26A(R1)' and 26D(R1)' would be the loudspeaker conductors 26A(R1) and 26D(R1) of Figure 1 connected differently at their respective ends.

The other terminals of the remote units 34A and 34D are connected to respective BLACK terminals of the audio transducers 14A(L) and 14D(L), respectively, as in the embodiment of Figure 1.

In this modified system, one of the usual four conductors used to connect the loudspeakers to the audio distribution unit 10, two conductors per loudspeaker, is reallocated. Thus, in zone A, the first conductor 26A(L1) serves to connect the BLACK terminals of both of the two loudspeakers 14A(L) and 14A(R) to the audio distribution unit ground 1, and the second and fourth conductors 26A(L2) and 26A(R2), with the first conductor, supply the RIGHT and LEFT channel audio signals to the LEFT and RIGHT loudspeakers, respectively. The third conductor 26A(R1)', and the first conductor 26A(L1) supply power to the remote unit 34A and communicate control signals to and from it. The speakers and remote units in the other zones are connected in a similar manner.

Generally, it is envisaged that, providing the distance between the loudspeakers and the audio distribution unit 10 is not too great, cross talk or reduction in stereo separation will not be unacceptable. Where the situation precludes it, perhaps because the distance is much greater, the embodiments which use separate grounds would be used instead.

Although the above-described embodiments have been shown, and described, with the audio distribution unit connected to the various sets of

audio transducers, the invention comprehends audio distribution units and remote units supplied as a kit, without the audio transducers. Moreover, although the above-described embodiments have input means for receiving audio signals from separate sources, the input means could itself comprise one or more of such sources, for example as a tuner-amplifier unit with input ports for connecting to a tape deck, CD player, DVD player, and so on.

Although embodiments of the invention have been described and illustrated in detail, it is to be clearly understood that the same are by way of illustration and example only and not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the appended claims.

CLAIMS

What is claimed is:

1. Apparatus comprising an audio distribution unit (10) having means (11) for providing audio signals from audio sources and output ports (12A...12D) for supplying sets of audio transducers, each said set comprising at least a first audio transducer (14A(L)) and a second audio transducer (14A(R)) and having associated therewith at least one remote unit (34A), the first and second audio transducers (14A(L),14A(R)) and the remote unit (34A) being connected to the audio distribution unit (10) by a set of four conductors, the apparatus further comprising means (22A...22D,44,76,80-96) for supplying audio signals to the audio transducers (14A(L),14A(R)) and transferring at least one of power and data signals between said audio distribution unit (10) and said remote unit (34A), all by way of the four conductors.

2. Apparatus according to claim 1, wherein the audio distribution unit (10) comprises first and second power amplifiers (24A(L),24A(R)), a first conductor (26A(L1)) connects one terminal of each of said first and second audio transducers (14A(L),14A(R)) and one terminal of the remote unit (34A) to a ground terminal of the audio distribution unit (10), a second (26A(L2)) of the conductors connects a drive-signal terminal of said first audio transducer (14A(L)) to a corresponding output terminal (30A(L)) of said first power amplifier (24A(L)), a third conductor (26A(R1)') connects a second terminal of the remote unit (34A) to an interface unit (44) of the audio distribution unit (10), and a fourth conductor (26A(R2)) connects a drive-signal terminal of said second audio transducer (14A(R)) to a corresponding output terminal (30A(R)) of said second power amplifier (24A(R)), the audio signals being supplied by way of the first, second and fourth conductors and the at least one of power and data signals being transferred by way of the first and third conductors.

3. Apparatus according to claim 1, wherein the audio distribution unit (10) comprises first and second power amplifiers (24A(L),24A(R)) each connected to a respective one of two grounds (1,2) that are separated electrically from each other, a first conductor (26A(L1)) connects one drive-signal terminal of

the first audio transducer (14A(L)) to a ground terminal of the first power amplifier (24A(L)), a second conductor (26A(L2)) connects the other drive-signal terminal of the first audio transducer (14A(L)) to an output terminal (30A(L)) of the first power amplifier (24A(L)), a third conductor (26A(R1)) connects one terminal of the second audio transducer (14A(R)) to a ground terminal of the second power amplifier (24A(R)), and a fourth conductor (26A(R2)) connects the other drive-signal terminal of the second audio transducer (14A(R)) to a corresponding output terminal (30A(R)) of the second power amplifier (24A(R)), the audio signals being supplied to the first audio transducer (14A(L)) by way of the first and second conductors, and to the second audio transducer (14A(R)) by way of the third and fourth conductors, and said at least one of power and data signals being transferred by way of the first (26A(L1)) and third (26A(R1)) conductors.

4. Apparatus comprising an audio distribution unit (10) having means (11) for providing audio signals from audio sources and output ports (12A...12D) each having a line terminal and a ground terminal, at least one set of audio transducers, said set comprising at least a first audio transducer (14A(L)) and a second audio transducer (14A(R)) connected to a respective set (12A(L), 12A(R)) of said output ports by a set of conductors comprising a first conductor (26A(L1)), a second conductor (26A(L2)), a third conductor (26A(R1)) and a fourth conductor (26A(R2)), said apparatus further comprising at least one remote unit (34A) associated with said set of audio transducers, wherein the audio distribution unit (10) has a first ground (1) and a separate second ground (2), said set of output ports including a first output port (12A(L)) and a second output port (12A(R)) connected to the first ground (1) and second ground (2), respectively, said first conductor (26A(L1)) and said second conductor (26A(L2)) connecting respective drive-signal terminals of said first audio transducer (14A(L)) to the ground terminal and line terminal, respectively, of said first output port (12A(L)), and said third conductor (26A(R1)) and said fourth conductor (26A(R2)) connecting respective drive signal terminals of said second audio transducer (14A(R)) to the ground terminal and line terminal, respectively, of said second output port (12A(R)),

the remote unit (34A) being connected to said first ground (1) and said second ground (2), the apparatus further comprising means (22A...22D,44,76,80-96) for transferring at least one of power and data signals between said audio distribution unit (10) and said remote unit (34A) by way of said first ground (1) and said second ground (2).

5. Apparatus according to claim 4, wherein the remote unit (34A) is connected to the first ground (1) and second ground (2) by the first conductor (26A(L1)) and the third conductor (26A(R1)), respectively, the power or data signals being transferred by way of these first and second conductors.

6. Apparatus according to claim 4, wherein the remote unit (34A) is connected to said first ground (1) and said second ground (2) by conductors other than the conductors connected to the drive signal terminals of the audio transducers (26A(L1),26A(L2),26A(R1),26A(R2)).

7. Apparatus according to claim 4, comprising a plurality of said sets of at least two audio transducers (14A(L),14A(R),...14D(L),14D(R)) connected to a corresponding plurality of sets of said output ports, and a corresponding plurality of remote units (34A...34D), each remote unit being connected to said first ground (1) and second ground (2) and associated with a respective one of the sets of audio transducers, and wherein the transferring means (44,76,80-96) comprises, at each of said remote units (34A-34D), means (84,90,94) for transmitting to said audio distribution unit (10) data signals including an identifier specific to the set of audio transducers with which that remote unit is associated and, at the audio distribution unit (10), means (40,44) for receiving said data signals and using said identifier to identify the remote unit, whereby the data signal was transmitted.

8. Apparatus according to claim 4, comprising a plurality of said sets of audio transducers (14A(L),14A(R),...14D(L),14D(R)) connected to a plurality of said sets of output ports (12A...12D) by a plurality of said sets of conductors, and a corresponding plurality of said remote units (34A,...34D), connected to

said first ground (1) and second ground (2), wherein at least one of said remote units (34A,...34D) is co-located with one of said sets of audio transducers and connected to the first ground (1) and the second ground (2) by one or more conductors of a said set of conductors connecting a different set of audio transducer units (14A,...14D) to the audio distribution unit (10) and the transferring means (44,76,80-96) comprises, at each of said remote units (34A-34D), means (84, 90, 94) for transmitting to said audio distribution unit (10) data signals each including an identifier specific to the set of audio transducers with which that remote unit is associated and, at the audio distribution unit (10), means (40,44) for receiving said data signals and using said identifier to identify the transmitting remote unit.

9. Apparatus according to claim 4, wherein the audio distribution unit (10) has a third ground (3) separate from both of the first ground (1) and the second ground (2), said set of output ports includes a third output port (12A(C)), said at least one set of audio transducers (14A(L),14A(R)) comprises a third audio transducer (14A(C)) and said set of conductors further comprises a fifth conductor (26A(C1)) and a sixth conductor (26A(C2)) connecting drive terminals of said third audio transducer (14A(C)) to ground and line terminals, respectively, of said third output port (30A(C)), the remote unit (34A') is connected also to the third ground (3), and the transferring means (44',76,80-96) is connected to the first, second and third grounds (1,2,3) for transference of power to the remote unit (34A') via one pair of the three grounds and transference of said data signals via a different pair of the three grounds (1,2,3).

10. Apparatus according to claim 4, wherein there is provided at least a second set of audio transducers (14B(L), 14B(R)) connected to the audio distribution unit (10) by a second set of conductors and a second remote unit (34B) associated therewith, and the audio distribution unit (10) has a third ground (3) separate from the first ground (1) and second ground (2) and a second set of said output ports (12B(L), 12B(R)) each having a ground terminal and a line terminal, the second set of output ports included one port (12B(L))

with its ground terminal connected to the ground (1) and another port (12B(R)) with its terminal connected to the third ground (3), drive terminals of one of the audio transducers (14B(L)) of the second set of audio transducers being connected to said one port (12B(L)) and drive terminals of a second audio transducer (14B(R)) of said second set being connected to said another output port (12B(R)), and wherein the transferring means (44,44/2,76,80-96) is connected also between said first ground (1) and said third ground (3) for transferring either or both of power and data signals also between said audio distribution unit (10) and said second remote unit (34B), the apparatus further comprising means (40) for determining the set of audio transducers to which a particular one of said data signals relates.

11. Apparatus according to claim 10, wherein the transferring means (44,44/2) is coupled to the first and second sets of audio transducers, respectively, and to the first, second and third grounds (1,2,3) the determining means (40) determining the set of audio transducers according to the interface unit whereby the data signal is communicated.

12. Apparatus according to claim 4, wherein the transferring means comprises, at the or each remote unit (34A-34D), transmitter means (84,90,94) coupled to the grounds for transmitting said data signals to the audio distribution unit (10) and, at the audio distribution unit (10), receiver means (72) coupled to said grounds for receiving said data signals and means (40) responsive to said data signals for controlling operation of said audio distribution unit (10) in dependence thereupon.

13. Apparatus according to claim 4, wherein the transferring means (44,76,80-96) comprises, at the audio distribution unit (10) transmitter means (50,66) for transmitting data signals via said grounds and the or each remote unit (34A...34D) further comprises corresponding receiver means (82) connected between the said grounds for receiving said data signals.

14. Apparatus according to claim 4, wherein said transferring means (44,76,80-96) comprises means (50,54) for establishing a potential difference between the pair of grounds used for power transfer and the remote unit (34A...34D) comprises means (76) coupled to the grounds for extracting power therefrom.

15. Apparatus according to claim 4, wherein the audio distribution unit (10) comprises a preamplifier unit (16) and one or more power amplifier units (22A...22D), each connected to a corresponding set of audio transducers by way of the corresponding set of output ports 12A...12D, the or each audio power amplifier unit 22A...22D comprising a first power amplifier (24A(L)...24D(L)), a second power amplifier (24A(R)...24D(R)) and a coupling device (32A...32D), the first power amplifier (24A(L)...24D(L)) having a ground terminal and an output terminal connected to, respectively, the ground terminal and line terminal of one (12A(L)...12D(L)) of the set of output ports, the ground terminal being connected also to said first ground (1), and an input terminal (21A(L)...21D(L)) connected to a first audio output port (20A(L)...20D(L)) of the preamplifier unit (16), the second power amplifier (24A(R)...24D(R)) having a ground terminal and an output terminal connected to, respectively, the ground terminal and line terminal of another (12A(R)...12D(R)) of the set of output ports, said coupling device (32A...32D) connecting a second audio output port (20A(R)...20D(R)) of the preamplifier (16) to an input (21A(R)...21D(R)) of the second power amplifier (24A(R)...24D(R)).

16. Apparatus according to claim 15, wherein the or each coupling device (32A...32D) comprises a differential amplifier having a signal output terminal and an output ground terminal connected to, respectively, an input (21A(R)...21D(R)) of the second power amplifier (24A(R)...24D(R)) and said second ground (2), a first input terminal connected to said first ground (1), and a second input terminal connected to said second audio output port (20A(R)...20D(R)) of the preamplifier unit (16).

17. Apparatus according to claim 15, wherein the or each coupling device (32A') comprises an isolation amplifier having an input connected to said second audio output port (20A(R)) of the preamplifier unit (16), and an output connected to an input (21A(R)) of the second power amplifier (24A(R)).

18. Apparatus according to claim 15, wherein the coupling device (32A) comprises a capacitor connected between said second audio output port (20A(R)) of the preamplifier unit (16) and an input of the second power amplifier (24A(R)).

19. Apparatus according to claim 4, wherein the remote unit (34A...34D) comprises infrared receiver means (106) for receiving an infrared signal from a separate control unit (107) and transmitter means (84,90,94) for transmitting corresponding signals via said grounds, and the audio distribution unit comprises means for detecting said corresponding signals.

20. Apparatus according to claim 4, wherein the remote unit (34A...34D) comprises voice circuitry (102) for converting signals from a microphone (96A') into voice signals for transmission to said audio distribution unit (10) and the audio distribution unit (10) further comprises means (16) for relaying the voice signals to one or more of said sets of audio transducer units.

21. Apparatus according to claim 20, wherein the remote unit (34A) includes means (84,90,94) for associating with the voice signal an address of said remote unit (34A) and the audio distribution unit (10) comprises means (40,16) for detecting said address and broadcasting the voice signals to audio transducer sets other than that from which the voice signals originated.

22. Apparatus according to claim 20, wherein the remote unit further comprises means (84,90,94) for associating with the voice signals an address of a recipient set of audio transducers to which the voice signals are to be sent, and the audio distribution unit (10) comprises means (40,16) for

detecting the address and controlling the audio distribution unit to transmit the voice signal to the recipient set of audio transducers.

23. Apparatus according to claim 14, wherein the means (76) for extracting power comprises means response to a voice control signal for modulating at least a part of the power extracted for the remote unit, the power transfer means at the audio distribution unit (10) comprises a constant current source and the audio distribution unit further comprises means for detecting the modulation as a corresponding fluctuation of a potential difference between said grounds to recover the voice signals and relaying the voice signals to one or more of said sets of audio transducer units, the remote unit further comprising voice circuitry (102) for converting signals from a microphone (96A) to produce said voice control signal.

24. Apparatus according to claim 23, wherein the remote unit has a backlight supplied with current by the power extraction unit and the power modulating means modulates the backlight current with the voice control signal.

25. Apparatus comprising an audio distribution unit (10) and a plurality of sets each of at least one audio transducer (14A(L), 14A(R)) connected by a signal transmission path to the audio distribution unit, at least one of the sets of at least one audio transducer being remote from the audio distribution unit and having a remote unit (34A) associated therewith, the remote unit comprising voice circuitry (102) for transmitting voice signals from a microphone (96A') via a transmission channel interconnecting the remote unit and the audio distribution unit, and means (84,90,94) for adding to the signals at least one address corresponding to one of the sets of audio transducers, and the audio distribution unit (10) comprises means (104) for extracting the voice signals from the transmission channel and applying the extracted voice signals to an input of the audio distribution unit (10), and means (16) for detecting the address and, in dependence thereon, directing the voice signals to one or more audio transducer sets other than that from which the voice signals originated.

26. Apparatus according to claim 25, wherein the means (84,90,94) for adding at least one address is arranged to add the address of at least one of the other audio transducer sets .

27. Apparatus according to claim 25, wherein the means (84,90,94) for adding at least one address adds only the address of the remote unit from which the voice signal is being transmitted, and the audio distribution unit comprises means (16,40) for detecting said address and distributing the voice signal to all audio transducer sets other than that set associated with the remote unit transmitting the voice signal.

28. Apparatus according to claim 25, wherein said transmission path and said transmission channel comprise the same medium.

29. Apparatus according to claim 28, wherein said transmission channel comprises a pair of conductors interconnecting one or more of the audio transducer units and the audio distribution unit.

30. Apparatus according to claim 4, further comprising an infrared transmitter coupled to the audio distribution unit for transmitting infrared control signals for controlling one of the audio sources, and wherein the remote unit comprises a receiver for receiving, from an infrared remote control device, infrared signals corresponding to said infrared control signals, generating in response thereto corresponding source control signals, and transmitting the source control signals to the audio distribution unit, the audio distribution unit having means for detecting said source control signals and controlling the infrared transmitter in dependence thereupon to generate said infrared control signals.

31. Apparatus according to claim 30, wherein said means for transmitting said data signals and said means for transmitting the source control signals transmit their respective signals via the same transmission path but each using a different form of modulation.

32. Apparatus according to claim 31, wherein the means for transmitting the source control signals uses amplitude shift keying (ASK) and the means for transmitting the data signals uses frequency shift keying (FSK).

33. Apparatus comprising an audio distribution unit (10) having means (11) for providing audio signals from at least one audio source controllable by infrared control signals, at least one audio transducer at a location remote from the audio distribution unit and connected thereto by a signal transmission path, and a remote unit associated with the audio transducer and connected thereto by a transmission channel, the apparatus further comprising an infrared transmitter for transmitting said infrared control signals for controlling said audio source, and wherein the remote unit comprises a receiver for receiving, from an infrared remote control device, infrared signals corresponding to said infrared control signals, generating in response thereto corresponding source control signals, and transmitting the source control signals to the audio distribution unit by way said transmission channel, the audio distribution unit having means for detecting said source control signals and controlling the infrared transmitter in dependence thereupon to generate said infrared control signals.

34. Apparatus according to claim 33, wherein the means for transmitting said data signals and said means for transmitting the source control signals transmit their respective signals via the same transmission path but each using a different form of modulation.

35. Apparatus according to claim 30, wherein the means for transmitting the source control signals uses amplitude shift keying (ASK) and the means for transmitting the data signals uses frequency shift keying (FSK).

36. Apparatus according to claim 33, wherein said transmission path and said transmission channel comprise the same medium.

37. Apparatus according to claim 36, wherein said transmission channel comprises a pair of conductors interconnecting one or more of the audio transducer units and the audio distribution unit.

38. An audio distribution unit (10) for the apparatus of claim 4 and having means (11) for providing audio signals from audio sources, a first ground (1), a separate second ground (2), at least one set of output ports (12A...12D) each having a line terminal and a ground terminal, said set of output ports including a first output port (12A(L) and a second output port (12A(R)), each having a line terminal and a ground terminal, having their respective ground terminals connected to the first ground (1) and second ground (2), respectively, and their line terminals for connection to a first and a second, respectively, of a corresponding set of audio transducers, and means (44) for transferring by way of said first ground (1) and said second ground (2) and said first and second output ports at least one of power and data signals between said audio distribution unit (10) and a remote unit (34A) associated with said set of audio transducers.

39. An audio distribution unit according to claim 38, for use with a plurality of said sets of at least two audio transducers (14A(L),14A(R),...14D(L),14D(R)) connected to a corresponding plurality of sets of said output ports, and a corresponding plurality of remote units (34A...34D), each remote unit being connected to said first ground (1) and second ground (2) and associated with a respective one of the sets of audio transducers, the transferring means (76,80-96) at each of said remote units (34A-34D) comprising means (84,90,94) for transmitting to said audio distribution unit (10) data signals including an identifier specific to the set of audio transducers with which that remote unit is associated, the audio distribution unit (10) further comprising means (40,44) for receiving said data signals and using said identifier to identify the remote unit whereby the data signal was transmitted.

40. An audio distribution unit according to claim 39, for use in apparatus according to claim 8, further comprising means (40,44) for receiving said data signals and using said identifier to identify the transmitting remote unit.

41. An audio distribution unit according to claim 38, for use in the apparatus according to claim 9, further comprising a third ground (3) separate from both of the first ground (1) and the second ground (2), and wherein said set of output ports includes a third output port (12A(C)), and the transferring means (44') is connected to the first, second and third grounds (1,2,3) for transference of power to the remote unit (34A') via one pair of the three grounds and transference of said data signals via a different pair of the three grounds (1,2,3).

42. An audio distribution unit according to claim 38, for use in apparatus according to claim 10, further comprising a third ground (3) separate from the first ground (1) and second ground (2) and further comprising a second set of said output ports (12B(L), 12B(R)) each having a ground terminal and a line terminal, the second set of output ports included one port (12B(L)) with its ground terminal connected to the first ground (1) and another port (12B(R)) with its ground terminal connected to the third ground (3), drive terminals of one of the audio transducers (14B(L)) of the second set of audio transducers being connected to said one port (12B(L)) and drive terminals of a second audio transducer (14B(R)) of said second set being connected to said another output port (12B(R)), and wherein the transferring means (44,44/2) is connected also between said first ground (1) and said third ground (3) for transferring either or both of power and data signals also between said audio distribution unit (10) and said second remote unit (34B), the audio distribution unit further comprising means (40) for determining the set of audio transducers to which a particular one of said data signals relates.

43. An audio distribution unit according to claim 42, for use in apparatus according to claim 10, wherein the transferring means (44,44/2) comprises a first interface unit and a second interface unit coupled to the first and second

sets of output ports, respectively, and to different pairs of the first, second and third grounds (1,2,3), the determining means (40) determining the set of audio transducers according to the interface unit whereby the data signal is communicated.

44. An audio distribution unit according to claim 38, for use in apparatus according to claim 12, further comprising receiver means (72) coupled to said grounds for receiving said data signals and means (40) responsive to said data signals for controlling operation of said audio distribution unit (10) in dependence thereupon.

45. An audio distribution unit according to claim 38, for use in apparatus according to claim 13, wherein the transferring means (44) comprises transmitter means (50,66) for transmitting data signals via said grounds.

46. An audio distribution unit according to claim 38, for use in apparatus according to claim 14, wherein said transferring means (44) comprises means (54) for establishing a potential difference between the pair of grounds used for power transfer .

47. An audio distribution unit according to claim 38, for use in apparatus according to claim 15, further comprising a preamplifier unit (16) and one or more power amplifier units (22A...22D), each connected to a corresponding set of audio transducers by way of the corresponding set of output ports (12A...12D), the or each audio power amplifier unit (22A...22D) comprising a first power amplifier (24A(L)...24D(L)), a second power amplifier (24A(R)...24D(R)) and a coupling device (32A...32D), the first power amplifier (24A(L)...24D(L)) having a ground terminal and an output terminal connected to, respectively, the ground terminal and line terminal of one (12A(L)...12D(L)) of the set of output ports, the ground terminal being connected also to said first ground (1), and an input terminal (21A(L)...21D(L)) connected to a first audio output port (20A(L)...20D(L)) of the preamplifier unit (16), the second power amplifier (24A(R)...24D(R)) having a ground terminal and an output

terminal connected to, respectively, the ground terminal and line terminal of another (12A(R)...12D(R)) of the set of output ports, said coupling device (32A...32D) connecting a second audio output port (20A(R)...20D(R)) of the preamplifier (16) to an input (22A(R)...22D(R) of the second power amplifier (24A(R)...24D(R)).

48. An audio distribution unit according to claim 47, for use in apparatus according to claim 16, wherein the or each coupling device (32A...32D) comprises a differential amplifier having a signal output terminal and an output ground terminal connected to, respectively, an input (22A(R)...22D(R)) of the second power amplifier (24A(R)...24D(R)) and said second ground (2), a first input terminal connected to said first ground (1), and a second input terminal connected to said second audio output port (20A(R)...20D(R)) of the preamplifier unit (16).

49. An audio distribution unit according to claim 47, for use in apparatus according to claim 17, wherein the or each coupling device (32A') comprises an isolation amplifier having an input connected to said second audio output port (20A(R)) of the preamplifier unit (16), and an output connected to an input (22A(R) of the second power amplifier (24A(R).

50. An audio distribution unit according to claim 47, for use in apparatus according to claim 18, wherein the coupling device (32A) comprises a capacitor connected between said second audio output port (20A(R)) of the preamplifier unit (16) and an input of the second power amplifier (24A(R)).

51. An audio distribution unit according to claim 38, for use in apparatus according to claim 19, and comprising means for detecting, between said grounds, signals corresponding to infrared signals received by the remote unit.

52. An audio distribution unit according to claim 39, for use in apparatus according to claim 20, further comprises means (16) for relaying the voice

signals to one or more of said sets of output ports for said audio transducer units.

53. An audio distribution unit according to claim 52, for use in apparatus according to claim 21, further comprising means for detecting said address and broadcasting the voice signals to audio transducer sets other than that from which the voice signals originated.

54. An audio distribution unit according to claim 52, for use in apparatus according to claim 22, further comprising means (40,16) for detecting the address and controlling the audio distribution unit to transmit the voice signal to the recipient set of audio transducers.

55. An audio distribution unit according to claim 46, for use in apparatus according to claim 23, wherein the power transfer means (10) comprises a constant current source and the audio distribution unit further comprises means (40,16) for detecting the modulation as a corresponding fluctuation of a potential difference between said grounds to recover the voice signals and relaying the voice signals to one or more of said sets of output ports for the audio transducer units.

56. An audio distribution unit (10) for use with a plurality of sets each of at least one audio transducer (14A(L), 14A(R)) connected by a signal transmission path to the audio distribution unit, at least one of the sets of at least one audio transducer being remote from the audio distribution unit and having a remote unit (34A) associated therewith, the remote unit comprising voice circuitry (102) for transmitting voice signals from a microphone (96A') via a transmission channel interconnecting the remote unit and the audio distribution unit, and means (84,90,94) for adding to the signals at least one address corresponding to one of the sets of audio transducers, said audio distribution unit (10) comprising means (104) for extracting the voice signals from the transmission channel and means (16) for detecting the address and, in

dependence thereon, directing the voice signals to one or more audio transducer sets other than that from which the voice signals originated.

57. An audio distribution unit according to claim 56, wherein the detecting means (16,40) is arranged to detect said address of at least one of the other audio transducer sets and direct said voice signals thereto.

58. An audio distribution unit according to claim 57, wherein the means (16,40) for detecting said address is arranged to distribute the voice signal to all audio transducer sets other than that set associated with the remote unit transmitting the voice signal.

59. An audio distribution unit according to claim 38, for use with a remote unit comprising a receiver for receiving, from an infrared remote control device, infrared signals corresponding to said infrared control signals, generating in response thereto corresponding source control signals, and transmitting the source control signals to the audio distribution unit, the audio distribution unit having an infrared transmitter coupled to the audio distribution unit for transmitting infrared control signals for controlling one of the audio sources, and means for detecting said source control signals and controlling the infrared transmitter in dependence thereupon to generate said infrared control signals.

60. An audio distribution unit according to claim 59, wherein said receiver is arranged to receive and demodulate both said data signals and said source control signals.

61. An audio distribution unit according to claim 60, wherein the receiver comprises means for demodulating said source control signals modulated using amplitude shift keying (ASK) and said data signals modulated using frequency shift keying (FSK).

62. An audio distribution unit (10) having means (11) for providing audio signals from at least one audio source controllable by infrared control signals,

and configured for use with at least one audio transducer at a location remote from the audio distribution unit and connected thereto by a signal transmission path, and a remote unit associated with the audio transducer and connected thereto by a transmission channel, the remote unit comprising a receiver for receiving, from an infrared remote control device, infrared signals corresponding to said infrared control signals, generating in response thereto corresponding source control signals, and transmitting the source control signals to the audio distribution unit by way of said transmission channel, the audio distribution unit having an infrared transmitter for transmitting said infrared control signals for controlling said audio source, and means for detecting said source control signals and controlling the infrared transmitter in dependence thereupon to generate said infrared control signals.

63. An audio distribution unit according to claim 62, wherein the receiver comprises means for receiving both said data signals and said source control signals via the same transmission path.

64. An audio distribution unit according to claim 62, wherein the receiver comprises means for demodulating said source control signals modulated using amplitude shift keying (ASK) and said data signals modulated using frequency shift keying (FSK).

65. An audio distribution unit according to claim 38, in an assemblage with one or more of said remote units.

66. Apparatus according to claim 1, wherein the remote unit (34A...34D) comprises infrared receiver means (106) for receiving an infrared signal from a separate control unit (107) and transmitter means (84,90,94) for transmitting corresponding signals to the audio distribution unit (10), and the audio distribution unit comprises means for detecting said corresponding signals.

67. Apparatus according to claim 1, wherein the remote unit (34A...34D) comprises voice circuitry (102) for converting signals from a microphone (96A')

into voice signals for transmission to said audio distribution unit (10) and the audio distribution unit (10) further comprises means (16) for relaying the voice signals to one or more of said sets of audio transducer units.

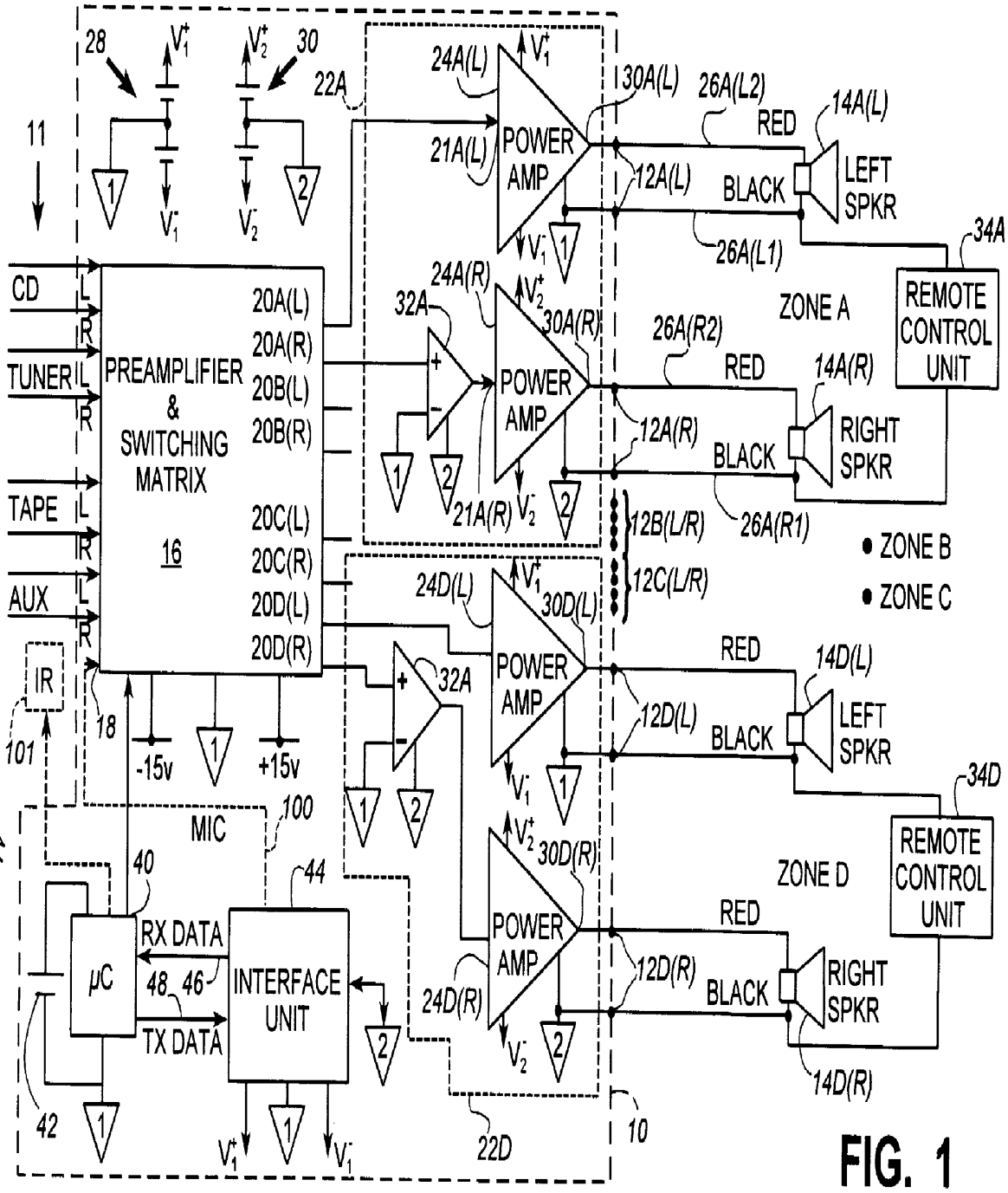


FIG. 1

Agent for Applicant

CA 02320451 2000-09-22

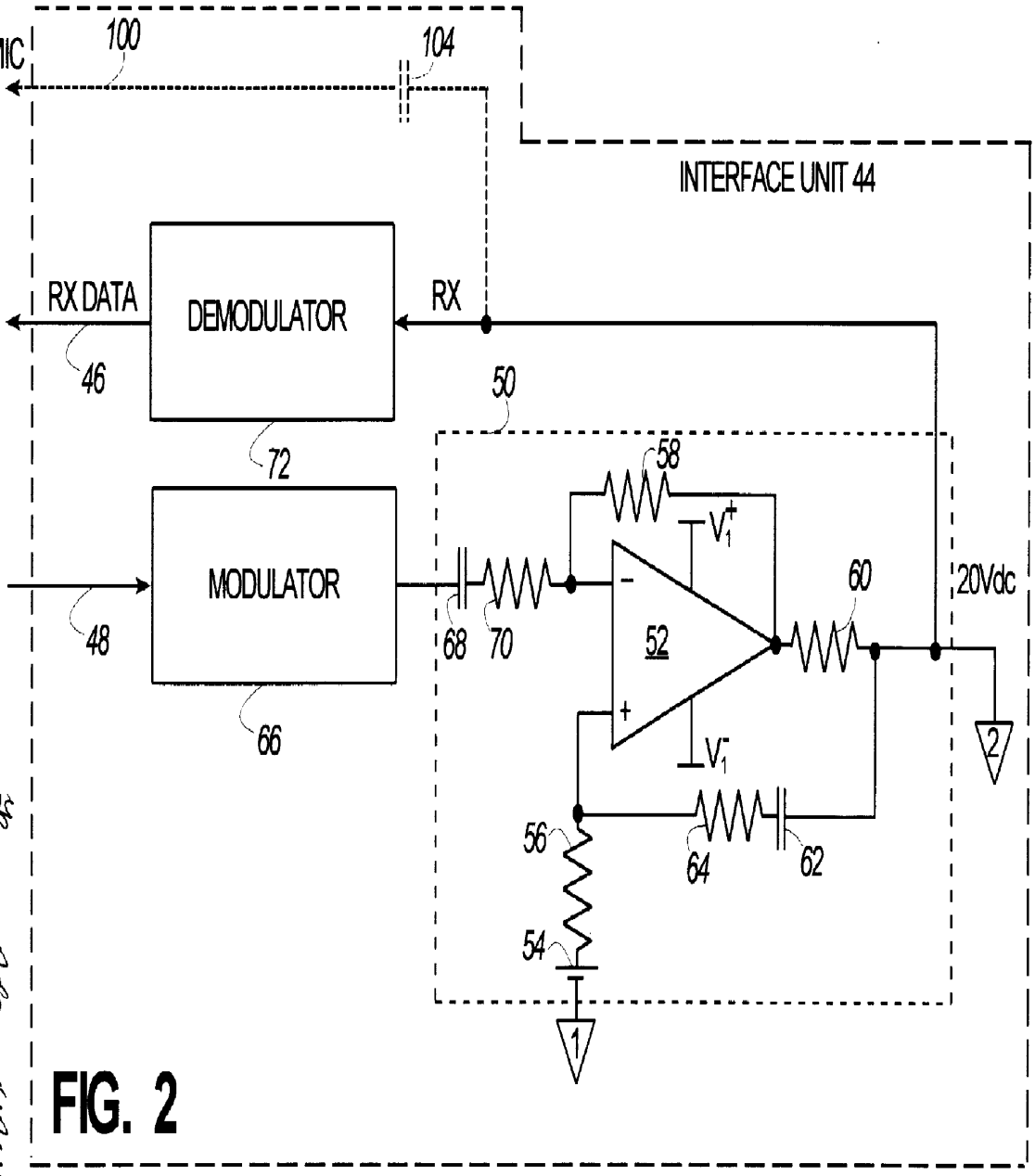


FIG. 2

Agent for Applicant

CA 02320451 2000-09-22

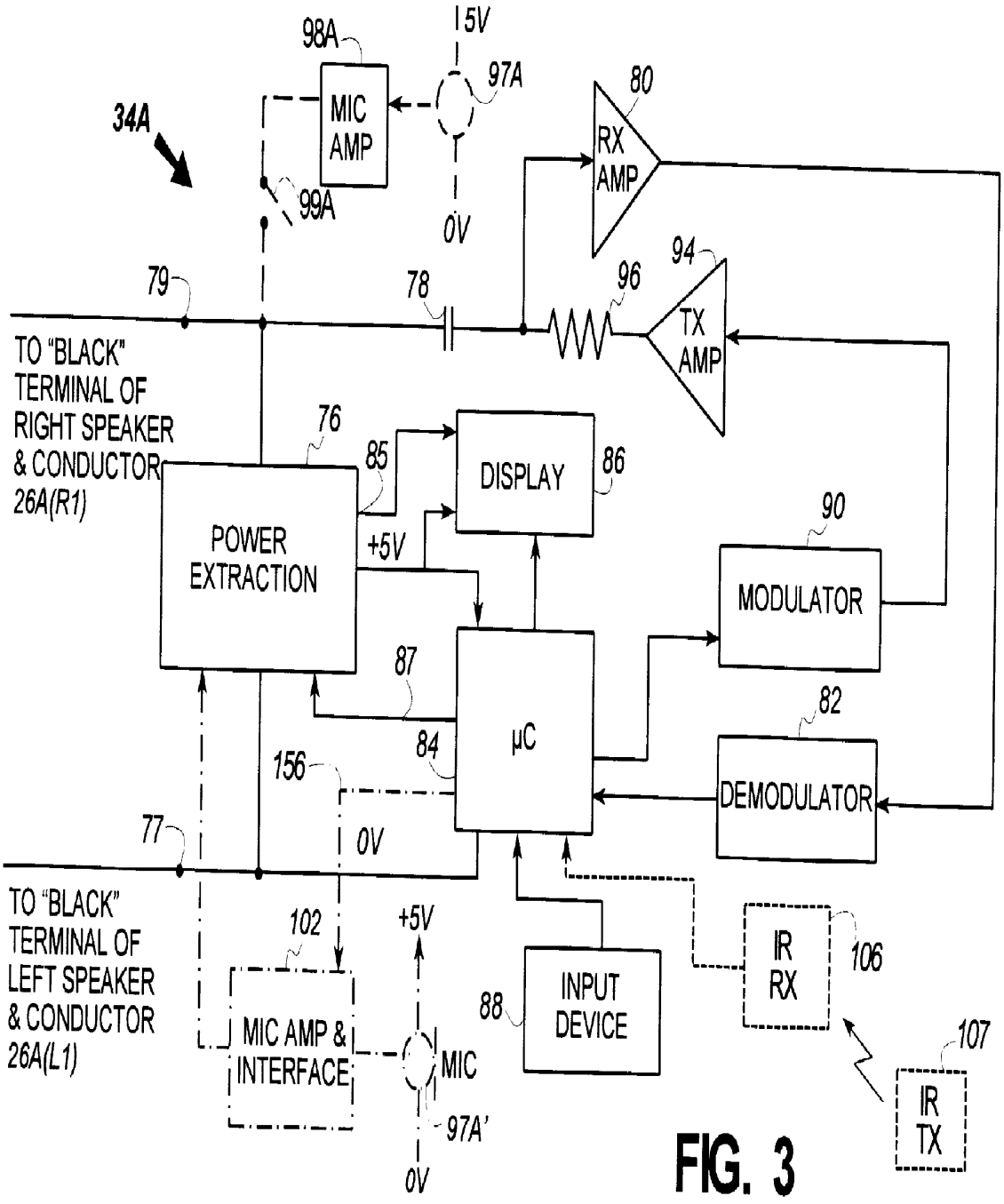


FIG. 3

Agent for Applicant

CA 02320451 2000-09-22

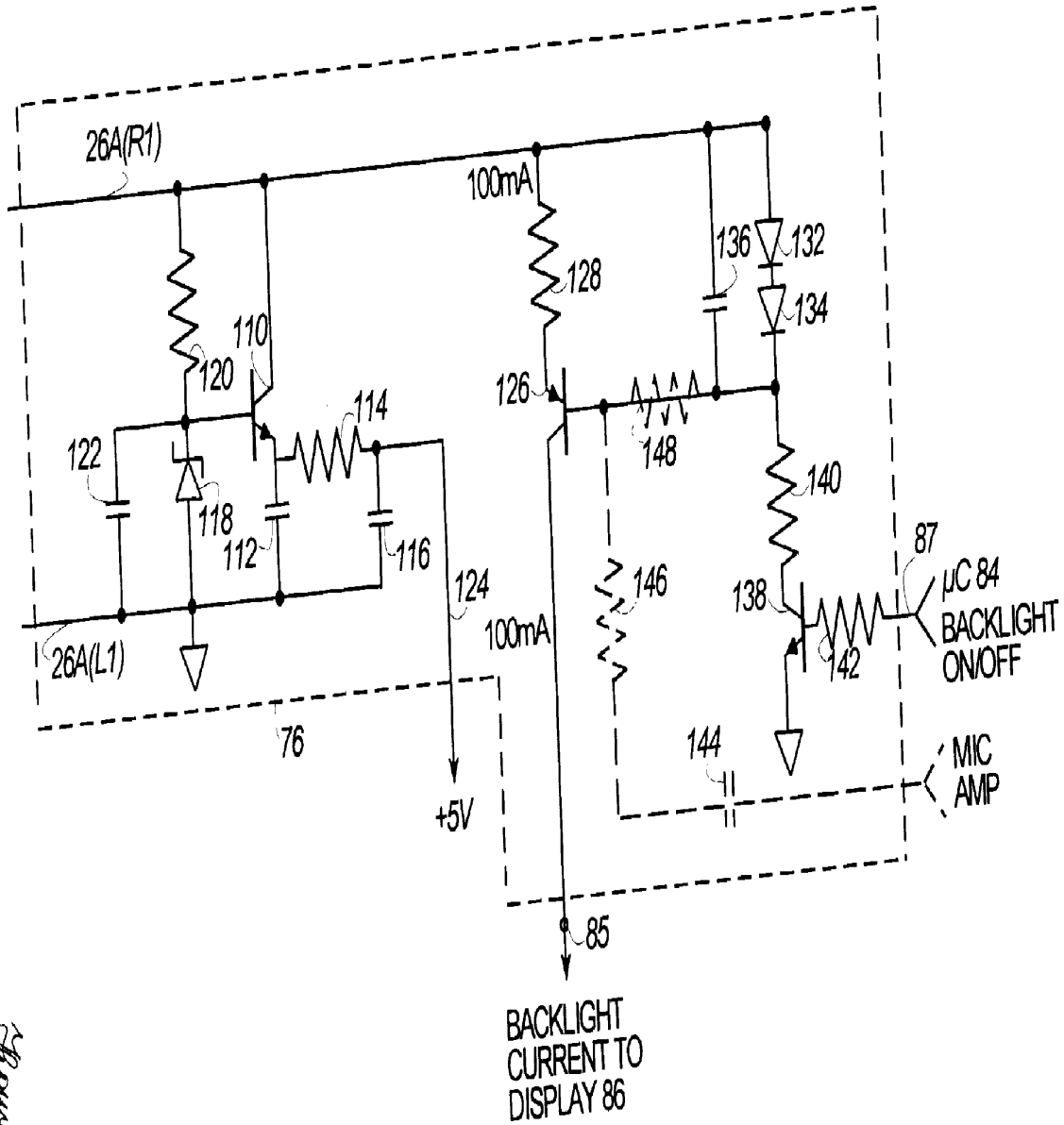


FIG. 4

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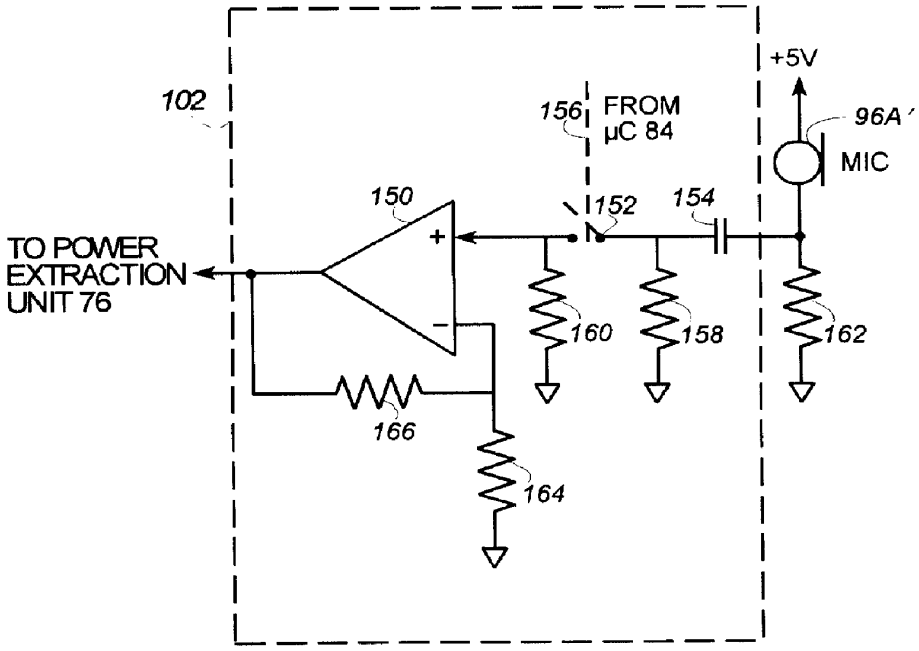


FIG. 5

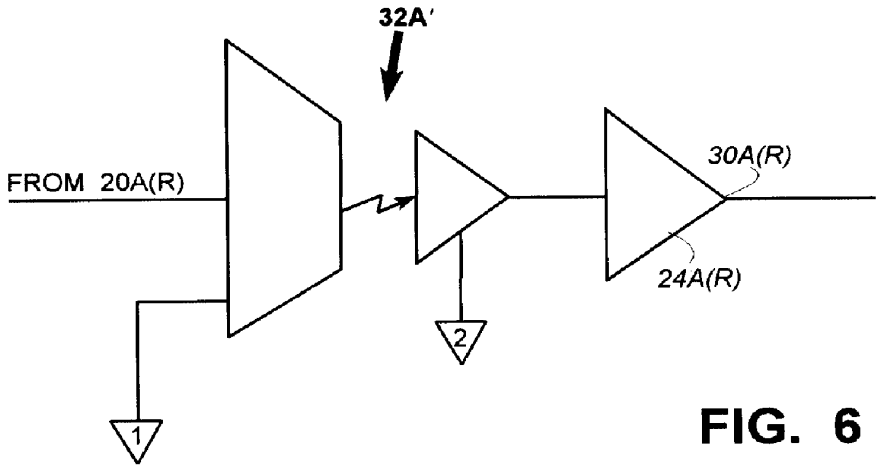


FIG. 6

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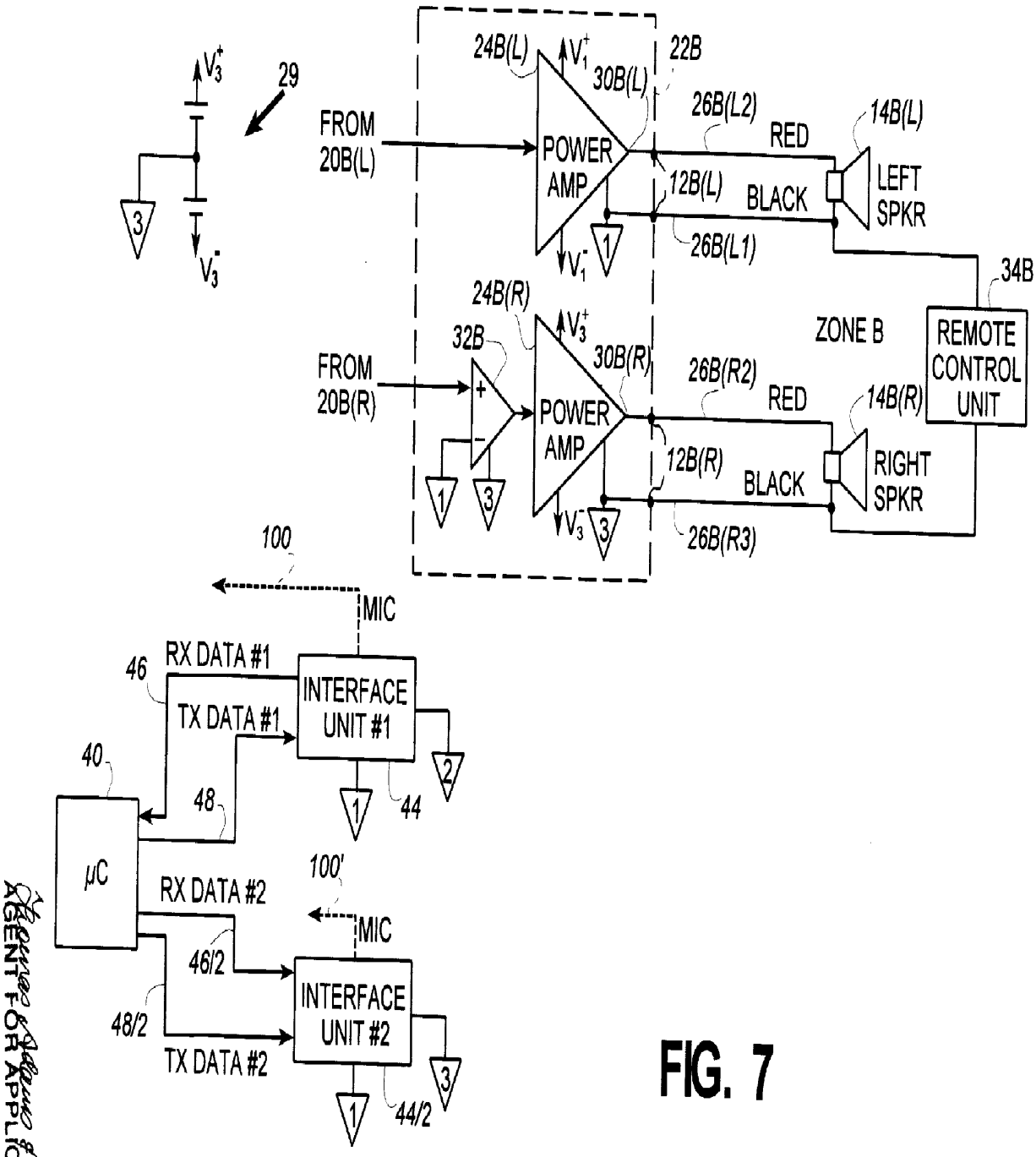


FIG. 7

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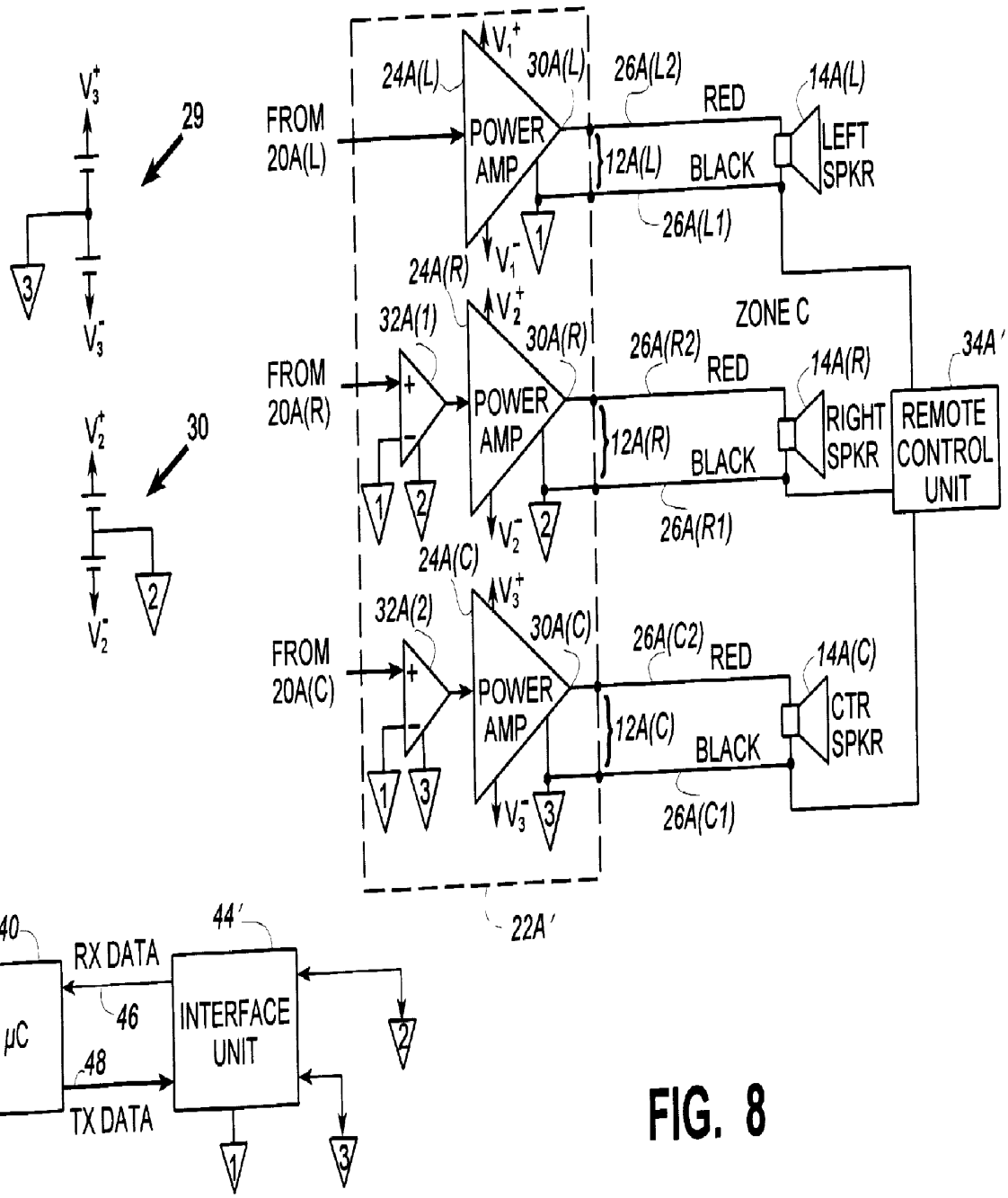


FIG. 8

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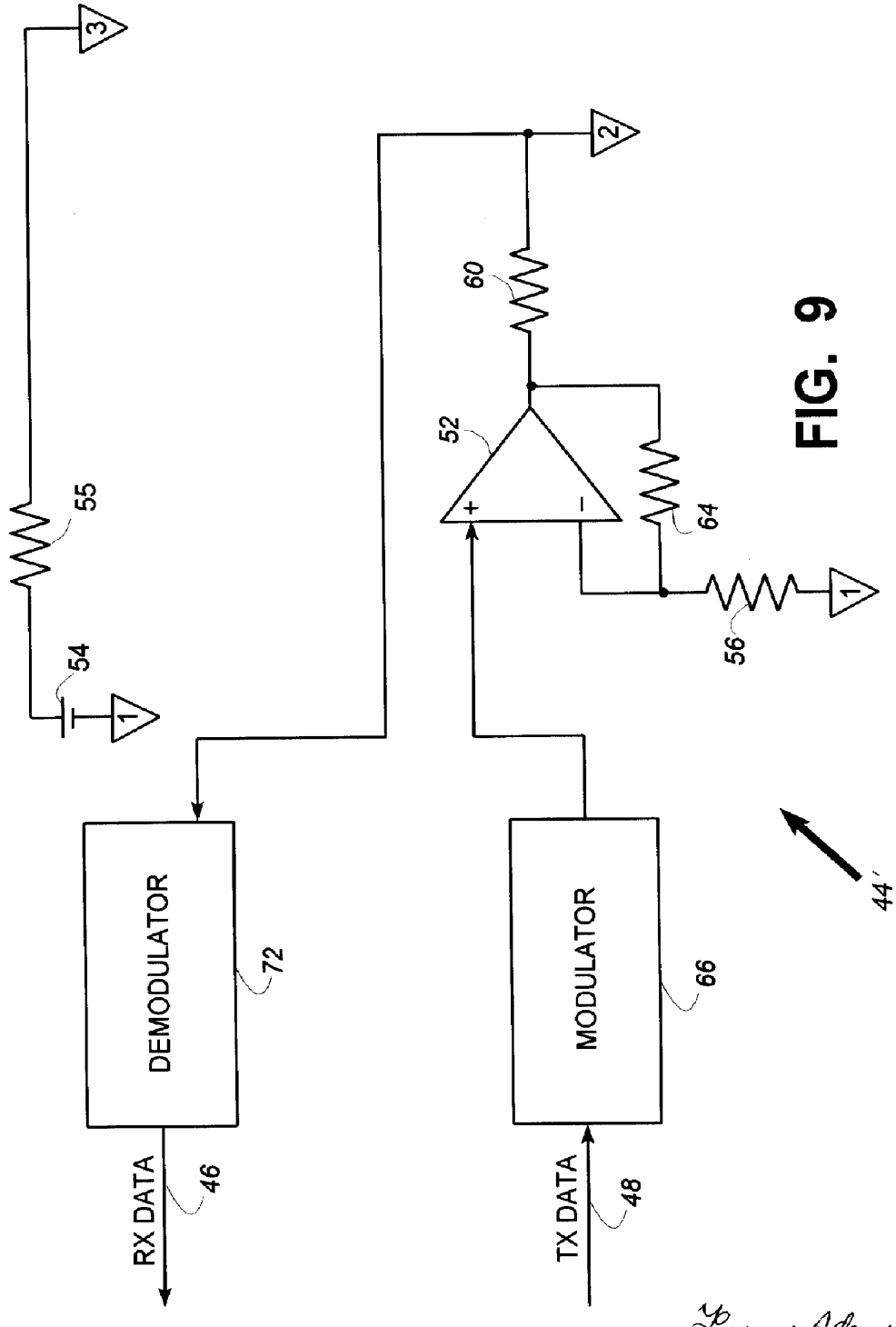


FIG. 9

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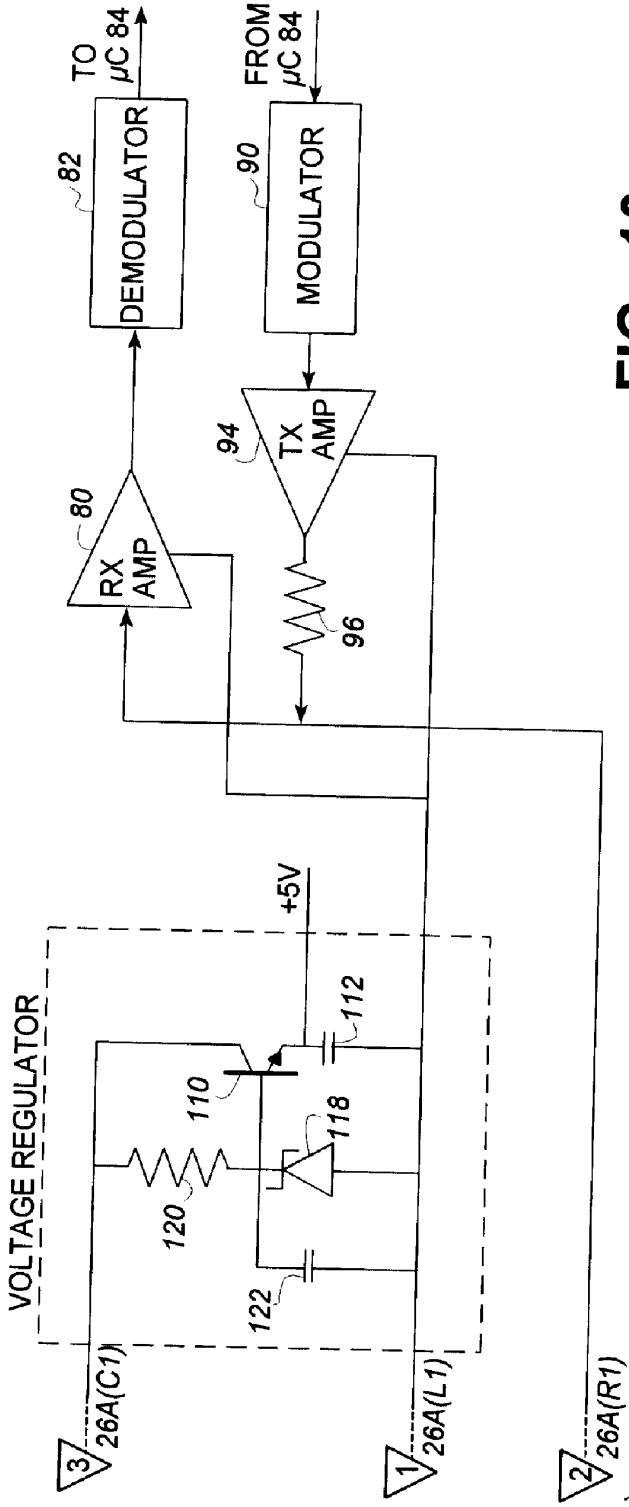


FIG. 10

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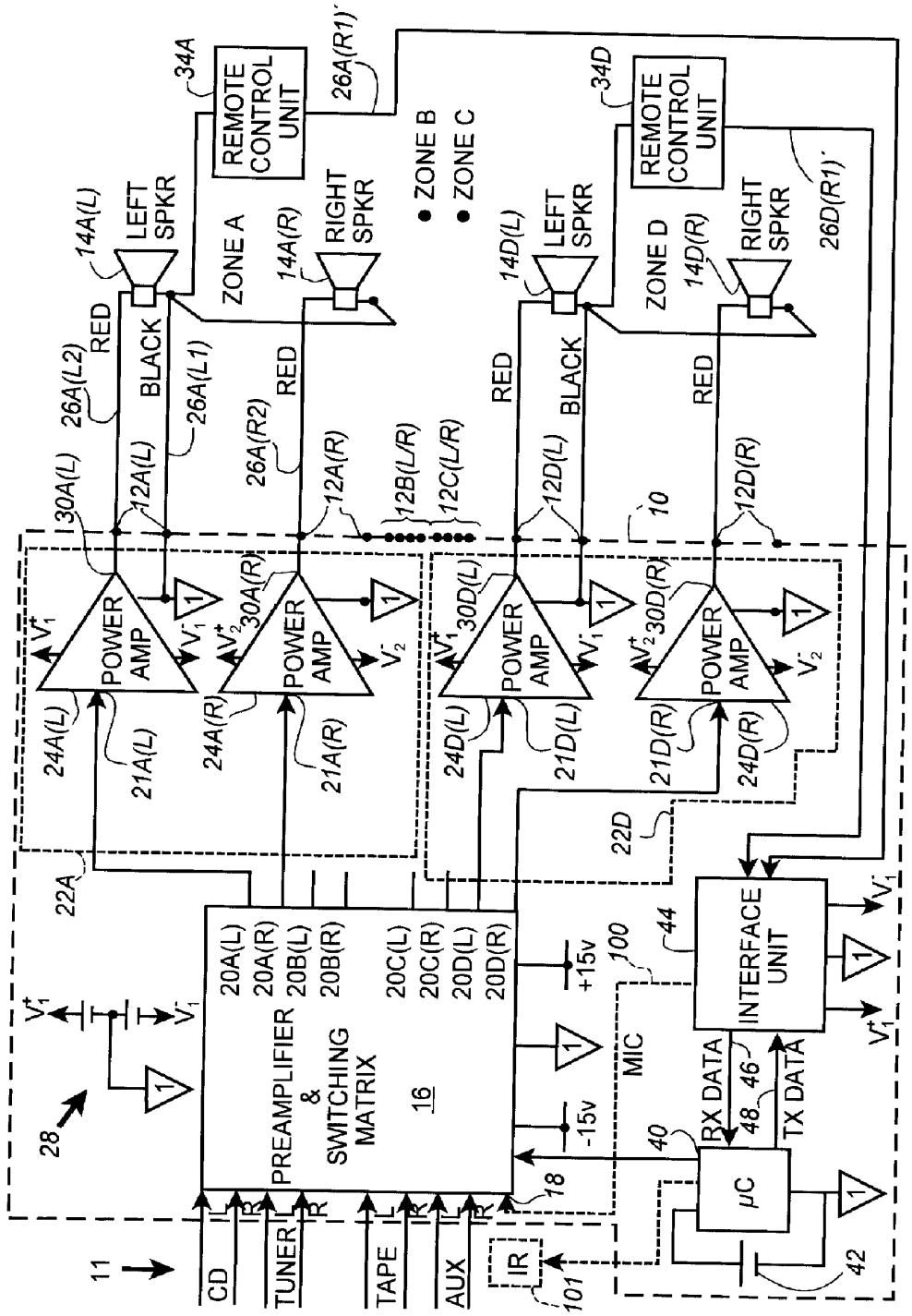


FIG. 11

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Espacenet

Bibliographic data: CN101292500 (A) — 2008-10-22

Mobile wireless communication terminals, systems, methods, and computer program products for providing a song play list

Inventor(s): THOMAS WASSINGBO [SE] + (WASSINGBO THOMAS)

Applicant(s): SONY ERICSSON MOBILE COMM AB [SE] + (SONY ERICSSON MOBILE COMMUNICATIONS AB)

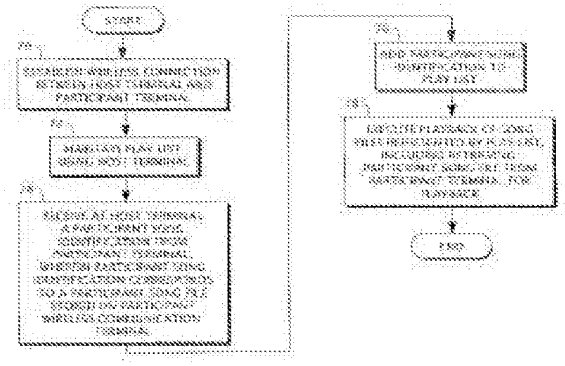
Classification: - international: *H04L29/08*
- cooperative: **H04M1/72519**; H04M1/72558

Application number: CN2006839085 20060816

Priority number(s): WO2006EP65350 20060816 ; US20050212201 20050826

Also published as: CN101292500 (B) WO2007023120 (A1) US2007049256 (A1) US7555291 (B2) JP2009506603 (A) more

Abstract of CN101292500 (A)



A mobile wireless communication terminal includes a wireless communication module and a controller. The wireless communication module is configured to communicate with other communication terminals over a wireless interface. The controller is configured to establish a connection with a participant wireless communication terminal via the wireless communication module, to maintain a play list representing song files to be played, to receive a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal, to add the participant song identification to the play list, and to thereafter execute playback of the song files represented by the play list,; including retrieving the participant song file from the participant wireless communication terminal for playback.

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[19] 中华人民共和国国家知识产权局

[51] Int. Cl.
H04L 29/08 (2006.01)

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[21] 申请号 200680039085.8
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[32] 2005.8.26 [33] US [31] 11/212,201
[86] 国际申请 PCT/EP2006/065350 2006.8.16
[87] 国际公布 WO2007/023120 英 2007.3.1
[85] 进入国家阶段日期 2008.4.21
[71] 申请人 索尼爱立信移动通讯股份有限公司
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代理人 曾祥麦 陈景峻

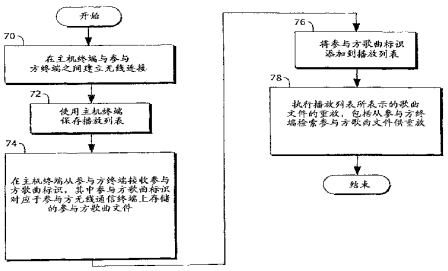
权利要求书 4 页 说明书 17 页 附图 4 页

[54] 发明名称

提供歌曲播放列表的移动无线通信终端、系统、方法和计算机程序产品

[57] 摘要

移动无线通信终端包括无线通信模块和控制器。无线通信模块配置成通过无线接口与其它通信终端进行通信。控制器配置成：经由无线通信模块与参与方无线通信终端建立连接；保存表示要播放的歌曲文件的播放列表；从参与方无线通信终端接收参与方歌曲标识，其中参与方歌曲标识对应于参与方无线通信终端上存储的参与方歌曲文件；将参与方歌曲标识添加到播放列表；以及此后执行播放列表所表示的歌曲文件的重放，包括从参与方无线通信终端检索参与方歌曲文件供重放。



1. 一种移动无线通信终端，包括:

无线通信模块，配置成通过无线接口与其它通信终端进行通信；以及

控制器，配置成：经由所述无线通信模块与参与方无线通信终端建立连接；保存表示要播放的歌曲文件的播放列表；从所述参与方无线通信终端接收参与方歌曲标识，其中所述参与方歌曲标识对应于所述参与方无线通信终端上存储的参与方歌曲文件；将所述参与方歌曲标识添加到所述播放列表；以及此后执行所述播放列表所表示的所述歌曲文件的重放，包括从所述参与方无线通信终端检索所述参与方歌曲文件供重放。

2. 如权利要求 1 所述的无线通信终端，其中所述控制器配置成：经由所述无线通信模块与多个参与方无线通信终端建立连接；从所述多个参与方无线通信终端接收多个参与方歌曲标识，其中每个参与方歌曲标识对应于所述多个参与方无线通信终端中的相应参与方无线通信终端上存储的相应参与方歌曲文件；将所述参与方歌曲标识中的每个添加到所述播放列表；以及从所述相应参与方无线通信终端中的每个检索所述参与方歌曲文件供重放。

3. 如权利要求 1 或 2 所述的无线通信终端，其中所述控制器配置成：从所述参与方无线通信终端将所述参与方歌曲文件作为流式音乐文件进行检索和执行。

4. 如权利要求 1 或 2 所述的无线通信终端，其中所述控制器配置成：从所述参与方无线通信终端检索所述参与方歌曲文件；在所述无线通信终端上存储所述参与方歌曲文件；以及此后执行所存储参与方歌曲文件的重放。

5. 如以上权利要求中任一项所述的无线通信终端，其中所述控制器配置成向媒体中心发送重放信号，以便在所述媒体中心上重放所述

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播放列表所表示的所述歌曲文件。

6. 如以上权利要求中任一项所述的无线通信终端，包括声换能器，其中所述控制器配置成使用所述声换能器来播放所述播放列表所表示的所述歌曲文件。

7. 如以上权利要求中任一项所述的无线通信终端，其中所述控制器配置成向至少一个参与方无线通信终端发送重放信号，以便在所述至少一个参与方无线通信终端上重放所述播放列表所表示的所述歌曲文件。

8. 如以上权利要求中任一项所述的无线通信终端，其中所述控制器配置成：从所述参与方无线通信终端接收表示所述参与方无线通信终端上存储的可用歌曲文件的歌曲目录列表；接收从所述可用歌曲文件选择的用户输入；以及将选择的可用歌曲文件添加到所述播放列表。

9. 如以上权利要求中任一项所述的无线通信终端，其中所述控制器配置成向所述参与方无线通信终端发送表示所述播放列表的列表信号，以便在所述参与方无线通信终端上显示所述播放列表。

10. 如以上权利要求中任一项所述的无线通信终端，其中所述控制器配置成响应用户输入而修改所述播放列表。

11. 如以上权利要求中任一项所述的无线通信终端，其中：

所述无线通信模块配置成通过直接点对点无线接口与其它通信终端进行通信；以及

所述控制器配置成：经由所述无线通信模块与所述参与方无线通信终端建立连接；从所述参与方无线通信终端接收所述参与方歌曲标识；以及全部经由所述直接点对点无线接口从所述参与方无线通信终端检索所述参与方歌曲文件供重放。

12. 如以上权利要求中任一项所述的无线通信终端，其中所述无线通信模块包括短程发射器，并且所述控制器配置成：与所述参与方无线通信终端建立连接；从所述参与方无线通信终端接收所述参与方歌曲标识；以及全部经由所述短程发射器从所述参与方无线通信终端

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检索所述参与方歌曲文件供重放。

13. 如权利要求 12 所述的无线通信终端，其中所述短程发射器是蓝牙发射器。

14. 如以上权利要求中任一项所述的无线通信终端，其中所述无线通信终端包括蜂窝电话。

15. 一种用于提供歌曲播放列表的系统，所述系统包括:

主机移动无线通信终端;

参与方无线通信终端;

其中所述主机无线通信终端包括:

无线通信模块，配置成通过无线接口与其它通信终端进行通信；以及

控制器，配置成：经由所述无线通信模块与所述参与方无线通信终端建立连接；保存表示要播放的歌曲文件的播放列表；从所述参与方无线通信终端接收参与方歌曲标识，其中所述参与方歌曲标识对应于所述参与方无线通信终端上存储的参与方歌曲文件；将所述参与方歌曲标识添加到所述播放列表；以及此后执行所述播放列表所表示的所述歌曲文件的重放，包括从所述参与方无线通信终端检索所述参与方歌曲文件供重放。

16. 如权利要求 15 所述的系统，包括多个参与方无线通信终端，并且其中所述控制器配置成：与所述多个参与方无线通信终端中的每个建立连接；从所述多个参与方无线通信终端接收多个参与方歌曲标识，其中每个参与方歌曲标识对应于所述多个参与方无线通信终端中的相应参与方无线通信终端上存储的相应参与方歌曲文件；将所述参与方歌曲标识中的每个添加到所述播放列表；以及从所述相应参与方无线通信终端中的每个检索所述参与方歌曲文件供重放。

17. 一种用于使用主机无线通信终端提供歌曲播放列表的方法，所述方法包括:

在所述主机无线通信终端与参与方无线通信终端之间建立无线连

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接;

使用所述主机无线通信终端保存播放列表，所述播放列表表示要播放的歌曲文件;

在所述主机无线通信终端从所述参与方无线通信终端接收参与方歌曲标识，其中所述参与方歌曲标识对应于所述参与方无线通信终端上存储的参与方歌曲文件;

将所述参与方歌曲标识添加到所述播放列表；以及

此后执行所述播放列表所表示的所述歌曲文件的重放，包括从所述参与方无线通信终端检索所述参与方歌曲文件供重放。

18. 一种用于使用主机无线通信终端提供歌曲播放列表的计算机程序产品，所述计算机程序产品包括:

计算机可用介质，其中包含有计算机可用程序代码，所述计算机可用程序代码包括:

配置成在所述主机无线通信终端与参与方无线通信终端之间建立无线连接的计算机可用程序代码;

配置成使用所述主机无线通信终端保存播放列表的计算机可用程序代码，所述播放列表表示要播放的歌曲文件;

配置成在所述主机无线通信终端从所述参与方无线通信终端接收参与方歌曲标识的计算机可用程序代码，其中所述参与方歌曲标识对应于所述参与方无线通信终端上存储的参与方歌曲文件;

配置成将所述参与方歌曲标识添加到所述播放列表的计算机可用程序代码；以及

配置成此后执行所述播放列表所表示的所述歌曲文件的重放、包括从所述参与方无线通信终端检索所述参与方歌曲文件供重放的计算机可用程序代码。

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提供歌曲播放列表的移动无线通信终端、系统、方法和计算机程序产品

技术领域

[001] 本发明涉及电子装置，更具体来说，涉及用于播放歌曲文件的电子装置、方法和计算机程序产品。

背景技术

[002] 移动电子装置如无线通信终端(例如蜂窝电话)广泛用于存储和重放歌曲文件。用户可能希望在另一个装置如媒体中心(例如 PC 或膝上型计算机、电视、音频接收器等)或者另一个无线通信终端上播放歌曲文件。如果其它装置配备了可以是集成模块或辅助(例如插接)模块的适当通信模块，则这可通过经由电缆或无线链路(例如蓝牙连接)将电子装置连接到其它装置来实现。歌曲文件可依次从一个或多个移动电子装置发送到重放装置。

发明内容

[003] 根据本发明的实施例，移动无线通信终端包括无线通信模块和控制器。无线通信模块配置成通过无线接口与其它通信终端进行通信。控制器配置成：经由无线通信模块与参与方无线通信终端建立连接；保存表示要播放的歌曲文件的播放列表；从参与方无线通信终端接收参与方歌曲标识，其中参与方歌曲标识对应于参与方无线通信终端上存储的参与方歌曲文件；将参与方歌曲标识添加到播放列表；以及此后执行播放列表所表示的歌曲文件的重放，包括从参与方无线通信终端检索参与方歌曲文件供重放。

[004] 控制器可配置成：与多个参与方无线通信终端建立连接；从

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多个参与方无线通信终端接收多个参与方歌曲标识，其中每个参与方歌曲标识对应于多个参与方无线通信终端中的相应参与方无线通信终端上存储的相应参与方歌曲文件；将参与方歌曲标识中的每个添加到播放列表；以及从相应参与方无线通信终端中的每个检索参与方歌曲文件供重放。

[005] 根据一些实施例，控制器配置成从所述参与方无线通信终端将所述参与方歌曲文件作为流式音乐文件进行检索和执行。

[006] 根据一些实施例，控制器配置成：从参与方无线通信终端检索参与方歌曲文件；在无线通信终端上存储参与方歌曲文件；以及此后执行所存储参与方歌曲文件的重放。

[007] 控制器可配置成向媒体中心发送用于在媒体中心重放播放列表所表示的歌曲文件的重放信号。

[008] 根据一些实施例，无线通信终端包括声换能器。控制器配置成使用声换能器来播放由播放列表所表示的歌曲文件。

[009] 控制器可配置成向至少一个参与方无线通信终端发送重放信号，用于在至少一个参与方无线通信终端上重放播放列表所表示的歌曲文件。

[010] 控制器可配置成：从参与方无线通信终端接收表示参与方无线通信终端上存储的可用歌曲文件的歌曲目录列表；接收从可用歌曲文件选择的用户输入；以及将选择的可用歌曲文件添加到播放列表。

[011] 根据一些实施例，控制器配置成向参与方无线通信终端发送表示播放列表的列表信号，用于在参与方无线通信终端显示播放列表。

[012] 控制器可配置成响应用户输入而修改播放列表。

[013] 根据一些实施例，无线通信模块配置成通过直接点对点无线接口与其它通信终端进行通信。控制器配置成：与参与方无线通信终端建立连接；从参与方无线通信终端接收参与方歌曲标识；以及全部经由直接点对点无线接口从参与方无线通信终端检索参与方歌曲文件供重放。

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[014] 根据一些实施例，无线通信模块包括短程发射器。控制器配置成：与参与方无线通信终端建立连接；从参与方无线通信终端接收参与方歌曲标识；以及全部经由短程发射器从参与方无线通信终端检索参与方歌曲文件供重放。短程发射器可以是蓝牙™发射器。

[015] 无线通信终端可包括蜂窝电话。

[016] 根据本发明的其它实施例，一种用于提供歌曲播放列表的系统包括主机移动无线通信终端和参与方无线通信终端。主机无线通信终端包括无线通信模块和控制器。无线通信模块配置成通过无线接口与其它通信终端进行通信。控制器配置成：经由无线通信模块与参与方无线通信终端建立连接；保存表示要播放的歌曲文件的播放列表；从参与方无线通信终端接收参与方歌曲标识，其中参与方歌曲标识对应于参与方无线通信终端上存储的参与方歌曲文件；将参与方歌曲标识添加到播放列表；以及此后执行播放列表所表示的歌曲文件的重放，包括从参与方无线通信终端检索参与方歌曲文件供重放。

[017] 根据一些实施例，该系统包括多个参与方无线通信终端。控制器配置成：与多个参与方无线通信终端中的每个建立连接；从多个参与方无线通信终端接收多个参与方歌曲标识，其中每个参与方歌曲标识对应于多个参与方无线通信终端中的相应参与方无线通信终端上存储的相应参与方歌曲文件；将参与方歌曲标识中的每个添加到播放列表；以及从相应参与方无线通信终端中的每个检索参与方歌曲文件供重放。

[018] 根据本发明的其它实施例，用于使用主机无线通信终端提供歌曲播放列表的方法包括：建立主机无线通信终端与参与方无线通信终端之间的无线连接；使用主机无线通信终端保存播放列表，该播放列表表示要播放的歌曲文件；在主机无线通信终端从参与方无线通信终端接收参与方歌曲标识，其中参与方歌曲标识对应于参与方无线通信终端上存储的参与方歌曲文件；将参与方歌曲标识添加到播放列表；以及此后执行播放列表所表示的歌曲文件的重放，包括从参与方无线

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通信终端检索参与方歌曲文件供重放。

[019] 根据本发明的其它实施例，用于使用主机无线通信终端提供歌曲播放列表的计算机程序产品包括其中包含有计算机可用程序代码的计算机可用介质，计算机可用程序代码包括：配置成在主机无线通信终端与参与方无线通信终端之间建立无线连接的计算机可用程序代码；配置成使用主机无线通信终端保存播放列表的计算机可用程序代码，播放列表表示要播放的歌曲文件；配置成在主机无线通信终端从参与方无线通信终端接收参与方歌曲标识的计算机可用程序代码，其中参与方歌曲标识对应于参与方无线通信终端上存储的参与方歌曲文件；配置成将参与方歌曲标识添加到播放列表的计算机可用程序代码；以及配置成此后执行播放列表所表示的歌曲文件的重放、包括从参与方无线通信终端检索参与方歌曲文件供重放的计算机可用程序代码。

[020] 通过阅读以下附图和优选实施例的详细描述，本领域的技术人员会了解本发明的其它特征、优点和细节，这种描述只是对本发明的说明。

附图说明

[021] 图 1 是根据本发明一些实施例的移动无线通信终端以及示范基站收发器的示意图。

[022] 图 2 是示出根据本发明一些实施例的方法的流程图。

[023] 图 3 是根据本发明一些实施例、包括图 1 移动无线通信终端的歌曲文件重放系统的示意图。

[024] 图 4 是示出根据本发明一些实施例、图 1 移动无线通信终端的显示的示意图。

[025] 图 5 是根据本发明的其它实施例、包括图 1 移动无线通信终端的歌曲文件重放系统的示意图。

[026] 图 6 是根据本发明的其它实施例、包括图 1 移动无线通信终端的歌曲文件重放系统的示意图。

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具体实施方式

[027] 现在将参照示出本发明实施例的附图更全面地描述本发明。但是，本发明不应当理解为局限于本文所述的实施例。相反，提供这些实施例，使得本公开是全面和完整的，并向本领域的技术人员全面地传达本发明的范围。相似的标号始终表示相似的要素。

[028] 本文所使用的术语"包括"或"包含"是开放式的，并且包括一个或多个所述特征、整数、要素、步骤、组件或功能，但并不排除存在或增加一个或多个其它特征、整数、要素、步骤、组件、功能或者它们的集合。

[029] 本文所使用的术语"和/或"包括关联的所列项中的一个或多个的任意一个和所有组合。

[030] 本文所使用的派生于拉丁短语"exempli gratia"的常见缩写词"例如"可用来介绍或详细说明先前所述项的一般实例或多个实例，而不是要限制这种项。在本文使用时，派生于拉丁短语"id est"的常见缩写词"即"可用于从更一般的叙述中详细说明某个特定项。

[031] 本文所使用的术语仅用于描述具体实施例的目的，而不是要限制本发明。本文所使用的单数形式"一个"和"该"意在也包含复数形式，除非上下文有明确说明。

[032] 除另有定义之外，本文所用的所有术语(包括科技术语)都具有与本发明所属领域的技术人员通常理解的同样的含义。还要理解，例如常用词典中定义的那些术语应当被认为具有与它们在相关领域的上下文中的含义一致的含义，并且不会以理想化或过分正式的意义来解释，除非本文中有明确定义。

[033] 要理解，当一个元件被称作"耦合到"或"连接到"另一个元件时，它可以直接耦合或连接到其它元件，或者也可存在中介元件。相反，当一个元件被说成是"直接耦合到"或者"直接连接到"另一个元件时，则不存在中介元件。此外，本文所使用的"耦合"或者"连接"可包括无线耦合或连接。

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[034] 为了简洁和/或清楚起见，可能没有详细描述众所周知的功能或构造。

[035] 本发明可实施为方法、电子装置和/或计算机程序产品。因此，本发明可以硬件和/或软件(包括固件、常驻软件、微码等)实施，它们在本文一般称作“电路”或“模块”。此外，本发明可采取计算机可用或计算机可读存储介质上的计算机程序产品的形式，所述介质中包含供指令执行系统使用或与其配合使用的计算机可用或计算机可读程序代码。在本文档的上下文中，“计算机可用或计算机可读介质”可以是可包含、存储、传递、传播或传送供指令执行系统、设备或装置使用的或者与其结合使用的程序的任何介质。

[036] 参照方法和通信终端的框图和/或可操作图示来描述根据本发明的实施例。在这方面，每个框可表示代码的模块、段或部分，它包含用于实现指定逻辑功能的一个或多个可执行指令。要理解，框图和/或可操作图示的每个框、框图和/或可操作图示中的框组合可通过射频、模拟和/或数字硬件和/或程序指令来实现。这些程序指令可提供给控制器，该控制器可包括一个或多个通用处理器、专用处理器、ASIC和/或其它可编程数据处理装置，使得经由控制器和/或其它可编程数据处理装置执行的指令创建用于实现框图和/或可操作框或多个框中指定的功能/动作的部件。在一些备选实现中，框中所示的功能/动作可不按照可操作图示中所述的顺序发生。例如，连续示出的两个框实际上可以基本上同时执行，或者这些框有时可按照相反顺序执行，取决于所涉及的功能/动作。

[037] 这些计算机程序指令还可存储在计算机可用或计算机可读存储器，其可指示计算机或其它可编程数据处理装置以特定方式运行，使得计算机可用或计算机可读存储器中存储的指令产生一种制品，其中包含实现在流程图和/或框图框或多个框中规定的功能的指令。

[038] 计算机可用或计算机可读介质例如但非限制地可以是电、磁、光、电磁、红外线或半导体系统、设备、装置或者传播介质。计

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算机可读介质的更具体实例(非详尽的列表)包括下列各项：硬盘、光存储装置、例如支持因特网或内联网的那些传输介质、磁存储装置、具有一条或多条导线的电连接、便携式计算机盘、随机存取存储器(RAM)、只读存储器(ROM)、可擦除可编程只读存储器(EPROM 或闪速存储器)、光纤以及只读光盘存储器(CD-ROM)。

[039] 用于执行本发明操作的计算机程序代码可通过例如 Java®、Smalltalk 或 C++等面向对象的编程语言来编写。但是，用于执行本发明操作的计算机程序代码也可通过例如“C”编程语言和/或低级汇编语言等传统面向过程的编程语言来编写。还要理解，任何或所有程序模块的功能性也可采用分立硬件组件、一个或多个专用集成电路(ASIC)或编程的数字信号处理器或微控制器来实现。

[040] 本文所使用的“电子组件”是指有源器件，与无源电连接器等相反。电子组件可包括处理器。

[041] 本文所使用的“流式传输”或“流式”是指例如音频或歌曲文件等文件经由数字信号连续发送到接收装置，在其中经由适当的接收应用程序同时播放该音频或歌曲文件。数字信号通常被缓冲。

[042] 本文所使用的“通信终端”包括但不限于配置成经由例如公共交换电话网(PSTN)、数字用户线(DSL)、数字电缆或另一个数据连接/网络等有线连接和/或经由与例如蜂窝网络、卫星网络、无线局域网(WLAN)和/或另一个通信终端的无线接口接收/发送通信信号的终端。

[043] 当通信终端配置成通过无线接口进行通信时，在本文称作“无线通信终端”或“无线终端”。无线终端的实例包括但不限于蜂窝电话、个人数据助理(PDA)、寻呼机和/或配置成通过无线通信接口传递数据的计算机，无线通信接口可包括蜂窝电话接口、蓝牙接口、无线局域网接口(例如 802.11)、另一个 RF 通信接口和/或光/红外通信接口。

[044] 本文所使用的“移动终端”可以是便携式、可移动、安装在(基于航空、航海或陆地的)交通工具中，或者设置成和/或配置成本地操作和/或以分布方式在地球上和/或空间的任何其它位置进行操作。

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[045] 下面结合图 1－6 来描述本发明的一些实施例。本发明的一些实施例提供能够提供歌曲播放列表的移动无线通信终端，该歌曲播放列表包含来自另一个无线通信终端的一个或多个歌曲标识。

[046] 现在参照图 1，说明根据本发明一些实施例的示范移动无线通信终端 10A。无线通信终端 10A 配置成通过其间的直接无线通信接口、通过经由一个或多个蜂窝基站的另一个无线通信接口和/或通过经由无线局域网(WLAN)路由器的另一个无线通信接口与一个或多个其它无线通信终端进行数据通信。

[047] 无线通信终端 10A 可以是组成无线电话通信系统 2 的一部分的移动无线电话，如图 1 所示。系统 2 包括移动无线通信终端 10A 以及作为无线通信网络 5 组成部分的基站收发器。在本发明的一些实施例中，网络 5 包括基站收发器，该基站收发器包括定义蜂窝网络中各个小区的无线电收发器，并使用无线电链路协议与移动终端 10A(经由接口 7)和小区中的其它移动终端进行通信。要理解，在本发明的一些实施例中，许多基站收发器可通过例如移动交换中心和其它装置进行连接，以便定义无线通信网络 5。

[048] 所示实施例中的移动终端 10A 包括便携壳体组件 12、显示器 20、包括扬声器 24(即声换能器)的用户接口 22(即人机接口(MMI))、控制器 30、通信模块 32 以及存储器 34。移动终端 10A 的上述部件可包含在许多常规移动终端中，并且它们的功能性是本领域技术人员普遍知道的。移动终端 10A 还包括可存储在存储器 34 中的歌曲管理模块 40。

[049] 显示器 20 可以是任何适当的显示屏组件。例如，显示屏 28 可以是具有或没有辅助照明(例如照明面板)的液晶显示器(LCD)。

[050] 用户接口 22 可包括任何适当的输入装置，例如包括触控或触敏装置(例如触摸屏)、操纵杆、键盘/小键盘、拨号盘、方向键和/或指示装置(例如鼠标、跟踪球、触摸垫等)。扬声器 24 响应输入音频信号而产生声音。用户接口 22 还可包括耦合到音频处理器的扩音器，该

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音频处理器配置成响应传入扩音器的声音而产生音频数据流。

[051] 控制器 30 可支持移动终端 10A 的各种功能。例如，控制器 30 可以是任何市场有售的或定制的微处理器。在使用中，移动终端 10A 的控制器 30 在显示器 20 上产生显示图像。

[052] 存储器 34 配置成存储数字信息信号和数据，例如数字音频信号和/或数字音频文件。

[053] 通信模块32配置成通过一个或多个无线接口(例如本文所述的无线接口 7、112、114、116、122 和 134(图 1 和图 3))向另一个远程无线通信终端传递数据，如本文所述。通信模块 32 可包括蜂窝通信模块、直接点对点连接模块和/或 WLAN 模块。

[054] 用蜂窝通信模块，无线通信终端 10A 可采用例如先进移动电话服务(AMPS)、ANSI-136、全球移动通信标准(GSM)、通用分组无线电业务(GPRS)、GSM 演进增强数据速率(EDGE)、码分多址(CDMA)、宽带 CDMA、CDMA2000 和通用移动电信系统(UMTS)等一个或多个蜂窝通信协议经由网络 5 的基站进行通信。蜂窝基站可连接到移动电话交换局(MTSO)无线网络，它又可连接到 PSTN 和/或另一个网络。

[055] 直接点对点连接模块可包括直接 RF 通信模块或直接 IR 通信模块。直接 RF 通信模块可包括蓝牙模块。用蓝牙模块，无线通信终端 10A 可经由自组网络通过直接点对点接口进行通信。

[056] 用 WLAN 模块，无线通信终端 10A 可通过 WLAN(例如路由器 120(图 3))采用可包括但不限于 802.11a、802.11b、802.11e、802.11g 和/或 802.11i 等通信协议进行通信。

[057] 通信模块 32 可包括通常具有发射器电路和接收器电路的收发器，发射器电路和接收器电路经由天线分别(例如向网络 5、路由器或直接向另一个终端)发送出局射频信号和(例如从网络 5、路由器或直接从另一个终端)接收入局射频信号、如语音和数据信号。通信模块 32 可包括短程发射器和接收器，例如蓝牙发射器和接收器。天线可以是嵌入式天线、收缩式天线或者本领域技术人员已知的任何天线，并没

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有背离本发明的范围。在移动终端 10A 与网络 5、路由器或其它终端之间发送的射频信号可包括业务和控制信号(例如寻呼信号/入局呼叫的消息)，它们用来与另一方或目的地建立和保持通信。射频信号还可包括分组数据信息，例如蜂窝数字分组数据(CDPD)信息。另外，收发器可包括配置成经由 IR 端口向/从其它电子装置发送/接收红外信号的红外(IR)收发器。

[058] 移动终端 10A 还可配置成经由有线或电缆与另一个终端电耦合，以便在其间传输数字通信信号。移动终端 10A 可包括其它组件，例如配置成根据入射光生成静止图像和/或视频数据流的相机装置。

[059] 根据一些实施例，移动终端 10A 是手持移动终端。“手持移动终端”是指移动终端的外部尺寸适于且适合由典型操作者单手使用。根据一些实施例，手持移动终端 10A 的总体积小于大约 200 立方厘米。根据一些实施例，手持终端 10A 的总体积小于大约 100 立方厘米。根据一些实施例，手持移动终端 10A 的总体积在大约 50 立方厘米与 100 立方厘米之间。根据一些实施例，手持移动终端 10A 的尺寸不超过大约 200 毫米。

[060] 现在参照图 2 的流程图来描述用于使用根据本发明一些实施例的无线通信终端(例如移动终端 10A)提供歌曲播放列表的方法。参照图 2 的实施例，该方法包括在主机无线通信终端与参与方无线通信终端之间建立无线连接(框 70)。使用主机无线通信终端来保存播放列表(框 72)。播放列表表示要播放的歌曲文件。在主机无线通信终端接收来自参与方无线通信终端的参与方歌曲标识(框 74)。参与方歌曲标识对应于或者指定参与方无线通信终端上存储的参与方歌曲文件。将参与方歌曲标识添加到播放列表(框 76)。此后，执行播放列表所表示的歌曲文件的重放(框 78)。执行歌曲文件的重放包括从参与方无线通信终端检索参与方歌曲文件供重放。

[061] 根据一些实施例，在主机无线通信终端与多个参与方无线通信终端之间建立连接，并且主机无线通信终端从多个参与方无线通信

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终端接收多个参与方歌曲标识，将参与方歌曲标识中的每个添加到播放列表，并从相应参与方无线通信终端中的每个检索参与方歌曲文件供重放。根据一些实施例，主机无线通信终端与参与方无线通信终端之间的通信经由直接点对点接口、如蓝牙无线 RF 连接来实现。根据一些实施例，主机无线通信终端与参与方无线通信终端之间的通信经由间接接口、例如通过 WLAN 或基于蜂窝的系统来实现。通过以下对其它实施例的描述，本发明的其它方面和实施例将显而易见。

[062] 参照图 3，其中示出根据本发明实施例的歌曲文件重放系统 100A。系统 100A 包括移动无线通信终端 10A(在本文又称作“主机无线通信终端”或“主机终端”)、多个附加的参与方无线通信终端 10B、10C、10D 和 10E(在本文又称作“参与方无线通信终端”或“参与方终端”)以及媒体中心 130。

[063] 终端 10B-E 可按照以上对于终端 10A 所述的方式来配置。终端 10B-E 各包括无线通信模块 32 和歌曲管理模块 40。但是，可根据装置的预期功能性，对于各终端 10A-E 以不同方式来配置相应的歌曲管理模块。根据一些实施例，终端 10B-E 中的所有或一些是移动无线通信终端。根据一些实施例，终端 10A-E 中的所有或一些是手持移动无线通信终端。

[064] 媒体中心 130 包括适合于将音频信号(例如数字音频信号)转换为对应声音的装置。媒体中心 130 可包括例如 PC 或膝上型计算机、电视机、音频接收器、立体声设备等。所示的媒体中心 130 包括无线通信模块 132 和声换能器(扬声器)136。无线通信模块 132 可与媒体中心 130 集成在一起，或者可以是辅助或插接的无线通信模块，例如蓝牙媒体查看器 MMV-100 模块或蓝牙媒体查看器 MMV-200 模块，均可从瑞典索尼爱立信购买。

[065] 现在采用用途的说明性实例来描述系统 100A。聚会的一组用户各具有终端 10A-E 中的相应一个。各种歌曲存储在终端 10A-E 的一个或多个(通常两个或更多)上。用户可能希望通过在媒体中心 130

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播放他们的歌曲，来与聚会的其他用户共享其移动终端上存储的歌曲。用已知的可用技术，这可通过一次一个让各用户(经由蓝牙等)向媒体中心 130 一首一首地发送他或她的歌曲(即音乐音频文件)来实现。但是，这种方法需要来自每个有贡献用户的大量且积极的交互作用。这种牵连可能是不方便的，和/或无助于环境(例如聚会)。

[066] 根据本发明的实施例，通过使用主机终端 10A 创建和保存歌曲的播放列表并执行歌曲(即音乐音频文件)的重放，可以克服上述缺点。通常，各终端 10A-E 中安装了适当的歌曲管理模块 40(例如软件或固件应用程序)。

[067] 将主机终端 10A 选择为主或主机终端，而参与方终端 10B-E 各指定为从或参与方终端。主机终端 10A 的控制器 30 与参与方终端 10B-E 中的每个建立无线连接(即在通信上耦合)。根据一些实施例，无线连接是直接无线通信接口连接，根据一些实施例是直接 RF 连接，而根据一些实施例是蓝牙连接。可通过已知方式来建立连接。例如，在蓝牙连接的情况下，参与方(从)终端 10B-E 可设置成可搜索/可发现状态，而主机(主)终端 10A 发出识别可用参与方(从)终端 10B-E 的查询，从而形成微微网或个人区域网络。

[068] 如图所示，主机终端 10A 分别经由直接点对点无线接口或链路 112、114 和 116 与参与方终端 10B、10C 和 10D 进行通信，并经由无线接口或链路 118、122 通过 WLAN 路由器 120 与参与方终端 10E 进行通信。要理解，根据一些实施例，接口可以是直接(例如蓝牙)或间接(例如经由 WLAN 路由器或蜂窝网络 5)的无线接口的各种组合。根据一些预期的实施例，在主机终端 10A 与参与方终端 10B-E 之间提供的执行歌曲共享过程的所有信号均经由直接点对点无线接口来提供。根据一些预期的实施例，在主机终端 10A 与参与方终端之间提供的执行歌曲共享过程的所有信号均经由直接无线射频(RF)接口、如蓝牙接口来提供。

[069] 在建立连接之前或之后，主机终端 10A 可通过任何适当的

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方法来识别和指定有效的参与方终端。根据一些实施例，主机终端 10A 将对所有或选择的一组潜在参与方终端(例如主机终端的蓝牙信号工作范围内的那些)进行轮询，或向其发送邀请。潜在参与方终端然后可通过以接受邀请的方式进行应答来决定参加。作为替代或补充，主机终端 10A 可接受来自参与方终端要求参加的自发请求。主机终端 10A 可用来定义特定的组，例如将被准许参加(即，向播放列表贡献歌曲)的潜在参与方终端的列表。

[070] 主机终端 10A 在通信上还耦合到媒体中心 130，以便经由无线接口或链路 134 向通信模块 132 提供无线歌曲数据信号。或者，主机终端 10A 可使用有线或信号电缆连接到媒体中心 130。

[071] 一旦在主机终端 10A 与参与方终端 10B-E 之间建立了连接，每个参与方就可发送指定参与方终端 10B-E 上存储的歌曲的参与方歌曲标识。发送参与方终端 10B-E 的歌曲管理模块 40 可提供用户接口以帮助选择和发送歌曲标识。例如，模块 40 可生成可用所存储歌曲的列表以及用于选择歌曲发送到主机终端 10A 的复选框。

[072] 主机终端 10A 从参与方终端 10B-E 接收参与方歌曲标识。主机终端 10A 的歌曲管理模块 40 创建和保存这些歌曲标识的主机播放列表。主机播放列表表示要播放的歌曲文件。

[073] 每个歌曲管理模块 40 在关联的终端 10A-E 上提供显示 150，如图 4 所示。在主机终端 10A 上提供的显示可不同于在参与方终端 10B-E 上提供的显示。例如，可从参与方终端显示中省略显示 150 中与管理功能性相关的部分。或者，歌曲管理模块 40 可以不在参与方终端 10B-E 上提供显示。

[074] 在所示的实施例中，显示 150 包括播放列表字段 152 和控制按钮 154(例如软键)。控制按钮 154 通常仅显示在主机终端显示器上。在播放列表字段 152 显示播放列表 156。播放列表 156 包括一系列一行一行显示的歌曲标识 156A，各对应于相应的歌曲文件。如图所示，每个歌曲标识包括歌曲艺术家、歌曲名称和对应于所关联歌曲文件的

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歌曲播放时间，以及提交了歌曲标识的参与方标识。要理解，也可提供或多或少和/或不同的信息。

[075] 例如，主机可使用控制按钮 154 有选择地管理歌曲列表 156 所表示的歌曲的播放。例如，“播放”和“停止”按钮可用于开始和停止向媒体中心 130 发送歌曲文件。“移动”按钮可用于对播放列表 156 中的歌曲标识 156A 确定优先顺序，或改变顺序(即改变将播放所关联歌曲文件的顺序)。“删除”按钮可用于从播放列表 156 中删除歌曲标识 156A。“详情”按钮可用于从播放列表 156 中删除歌曲标识 156A，使得不会播放所关联歌曲文件。“随机混合”按钮可用于使主机终端 10A 以随机或其它非连续顺序来执行歌曲文件的重放(即，向媒体中心 130 发送歌曲文件)。通常，主机终端 10A 将以所列的顺序来执行歌曲文件的重放，除非正在实行随机或其它非连续模式。

[076] 还可提供其它功能性。例如，主机终端 10A 可允许用户根据一个或多个选择的属性(例如有贡献的参与方、歌曲长度等)来改变歌曲标识 156A 的顺序。主机终端 10A 可配置成指定准许参与方终端 10B-E 中的哪一些向播放列表 156 添加歌曲标识。除了添加歌曲标识之外，还可使参与方终端 10B-E 能够编辑或修改歌曲列表 156。在这种情况下，主机终端 10A 可配置成允许主机选择授权或不授权参与方终端 10B-E 中的哪一些修改歌曲播放列表 156(即，启用和禁用参与方终端的播放列表编辑能力)。

[077] 当主机终端 10A 处于播放模式时，主机终端 10A 的控制器 30 将识别此后要播放的歌曲标识 156A。所识别的歌曲标识可以是接下来要播放的歌曲标识。然后，主机终端 10A 将向参与方终端 10B-E 中对应的一个发送歌曲文件请求，以便检索对应于该歌曲标识的歌曲文件。

[078] 然后，对应的参与方终端将向主机终端 10A 发送所标识歌曲文件(它存储在参与方终端上)的副本。根据一些实施例，参与方终端向主机终端 10A 发送歌曲文件，作为然后暂时存储在主机终端

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10A(例如在存储器 34 中)的歌曲文件的副本。根据其它实施例，参与方终端将歌曲文件作为流式歌曲文件发送到主机终端 10A。根据一些实施例，主机终端与参与方终端之间的请求和歌曲文件信号以无线方式发送，根据一些实施例，经由直接无线 RF 连接、如蓝牙进行发送。

[079] 然后，主机终端 10A 的控制器 30 通过向媒体中心 130 发送歌曲文件，来执行所检索歌曲文件的重放。歌曲文件可存储在媒体中心 130 供重放。或者，例如当歌曲文件从始发参与方终端流式传输到主机终端 10A 时，歌曲文件可流式传输到媒体中心 130。可能优选或必要的是，如果主机终端 10A 上的所分配存储空间不够，和/或在主机终端 10A 上存储歌曲文件被阻止或者是非法的，则将歌曲文件从参与方终端流式传输到主机终端，和/或从主机终端流式传输到媒体中心 130。根据一些实施例，无论歌曲文件是流式传输的还是整个存储的，都将在重放期间或之后从主机终端 10A 自动删除(即无需用户干预)。

[080] 主机终端 10A 的控制器 30 可依次地自动(即无需用户干预)对每个歌曲标识 156A 执行上述步骤。当主机终端 10A 以这种方式遍历歌曲列表 156 时，主机可根据需要修改播放列表 156。另外，根据一些实施例，当主机终端 10A 的控制器 30 遍历播放列表 156 时，参与方终端 10B-E 可向歌曲列表 156 添加新的歌曲标识。根据一些实施例，当主机终端 10A 遍历播放列表 156 时，新的参与方终端可加入该组并提交歌曲标识。

[081] 系统 100A 可提供用于播放一群人选择的歌曲的便利而有趣的机制。系统 100A 提供重放执行功能性，并且还允许主机终端(在某些情况下是参与方终端)创建、协调、控制和/或管理歌曲播放列表。实际上，例如，聚会常客可将歌曲从他们自己的参与方终端添加到主机终端(例如聚会主人自己的移动终端)上保存的歌曲播放列表。在重放序列中轮到他们的歌曲时，歌曲文件的副本将自动发送给主机终端并播放。这样，聚会常客无需采取其它任何动作。根据一些实施例，当请求和歌曲传送信号经由直接无线通信(例如 RF 接口、如蓝牙连接)

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在主机终端与参与方终端之间传递时，聚会常客可只将他或她的参与方终端放入口袋或手袋中。在执行该过程时，可添加或删除参与方。例如，当参与方离开蓝牙范围时，他或她的歌曲可从播放列表中删除或者向下移动。

[082] 现在参照图 5，其中示出根据本发明其它实施例的系统 100B，它包括主机终端 10A 和参与方终端 10B-E。系统 100B 与系统 100A(图 2)的不同之处在于，省略了媒体中心 130，并且来自歌曲播放列表 156 的歌曲文件重放经由主机终端 10A 的扬声器 24 进行。

[083] 现在参照图 6，其中示出根据本发明其它实施例的系统 100C，它包括主机终端 10A 和参与方终端 10B-E。系统 100C 与系统 100B(图 5)的不同之处在于，来自歌曲播放列表 156 的歌曲文件重放经由主机终端 10A 的扬声器 24 进行，并且另外还通过参与方终端 10B-E 的相应扬声器和/或通过在操作上连接到参与方终端 10B-E 的一个或多个耳机(例如耳式立体声耳塞)进行。更具体来说，主机终端 10A 的控制器 30 通过与以上所述相同的方式播放每个歌曲文件，并且还向参与方终端 10B-E 发送歌曲文件供同时重放。这样，主机终端 10A 创建和管理可包含来自参与方终端 10B-E 的歌曲标识的歌曲播放列表，根据需要从适当的参与方终端 10B-E 检索歌曲文件的副本，并向参与方终端 10B-E 分发歌曲文件的副本供重放。根据一些实施例，歌曲传送信号以无线方式从主机终端 10A 发送到参与方终端 10B-E，而根据一些实施例，经由直接无线 RF 连接、如蓝牙发送。根据一些实施例，将歌曲文件流式传输到参与方终端 10B-E。主机终端 10A 可配置成准许主机指定参与方终端 10B-E 中的哪一些将接收重放信号，以及参与方终端 10B-E 中的哪一些被授权向播放列表 156 提交歌曲标识，这两组可以不同。

[084] 主机终端 10A 可配置成允许用户从上述各种选项有选择地选取用于重放的装置或装置组合。例如，主机终端 10A 可配置成仅经由主机终端 10A 的扬声器 24、经由主机终端 10A 的扬声器和参与方终

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端 10B-E 的扬声器、经由参与方终端 10B-E 的扬声器和媒体中心 130 等来执行重放。要理解，当歌曲文件经由参与方终端 10B-E 的扬声器重放时，参与方终端中的一个给定终端的用户可禁用其扬声器，和/或可中继该歌曲文件以便在另一个装置(例如关联的另一个媒体中心等)上重放。

[085] 根据其它实施例，主机终端 10A 的控制器 30 可请求和/或接受从参与方终端主动提供的歌曲目录列表。歌曲目录列表包括表示参与方终端上每个歌曲文件的歌曲标识或者参与方希望可得到的所有这类歌曲文件的歌曲标识。此后，主机终端 10A 可使主机能够选择主机希望添加到播放列表的歌曲目录列表的歌曲标识。

[086] 本文所述的应用程序，包括歌曲管理模块 40，说明实现根据本发明实施例的各种特征的程序。要理解，根据本发明的实施例，可采用其它和/或附加应用程序。

[087] 虽然图 1 示出可在移动终端和/或其它电子装置中用于管理和重放歌曲文件的示范硬件/软件体系结构，但要理解，本发明不限于这样一种配置，而是要含盖能够执行本文所述操作的任何配置。例如，虽然存储器 34 示为与控制器 30 分开，但存储器 34 或者其若干部分也可视为控制器 30 的组成部分。更一般来说，虽然通过图解以具体的块示出了具体功能性，但不同块和/或其若干部分的功能性可被组合、划分和/或消除。此外，按照本发明的各种实施例，图 1 的硬件/软件体系结构的功能性可实现为单处理器系统或者多处理器系统。

[088] 给出了本公开的好处，本领域技术人员可做出许多改变和修改，并不背离本发明的精神和范围。因此必须理解，只是为了举例而阐述了所示实施例，而不应视为限制由以下权利要求书所定义的本发明。因此，以下权利要求书将理解为不仅包括字面阐述的要素的组合，而且还包括用于以基本相同方式执行基本相同功能以获得基本相同结果的所有等效要素。权利要求书因而要理解为包括以上具体说明和描述的、概念上等效的以及结合了本发明实质概念的内容。

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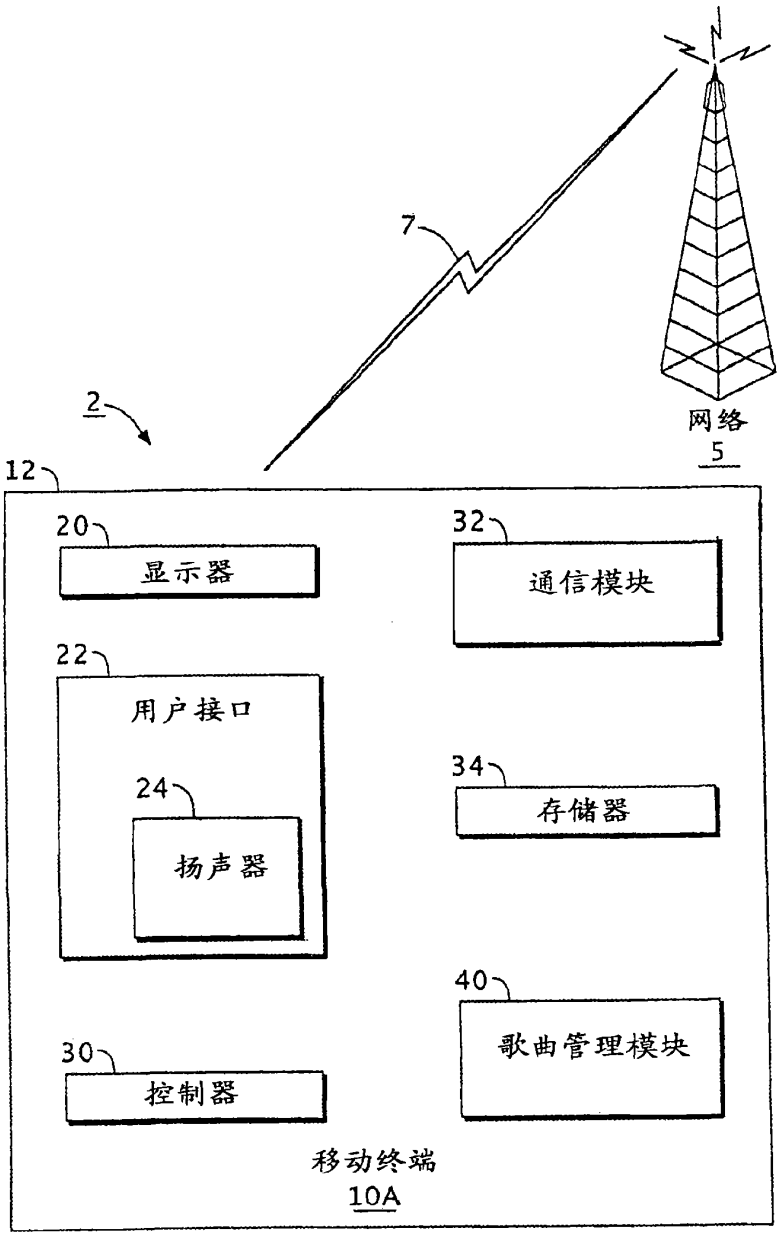


图 1

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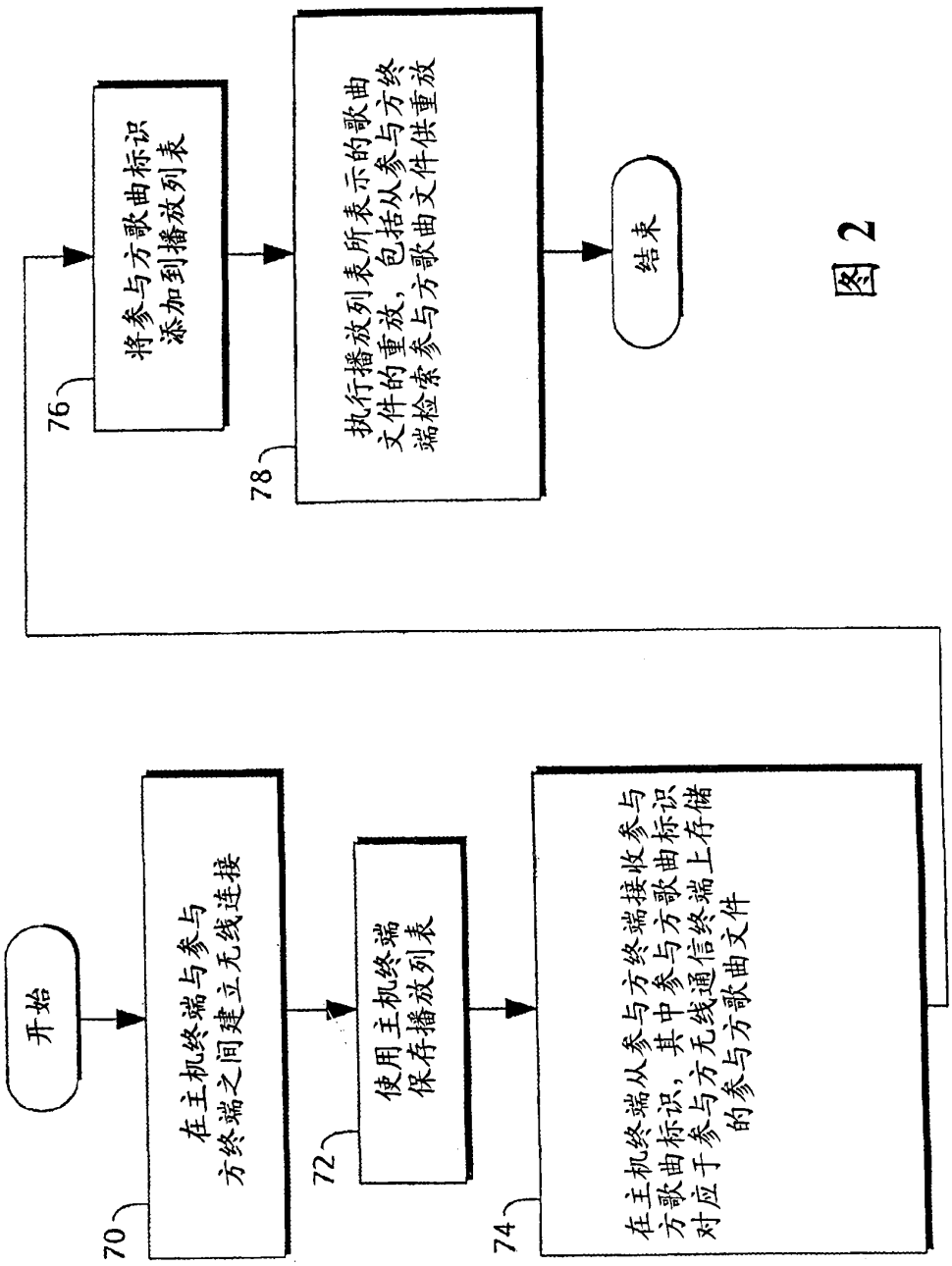


图 2

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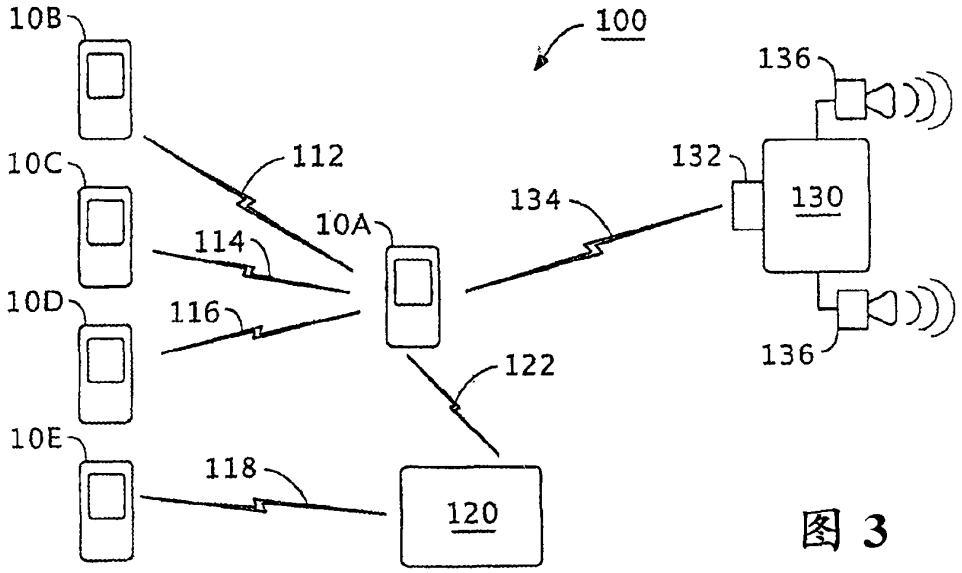


图 3

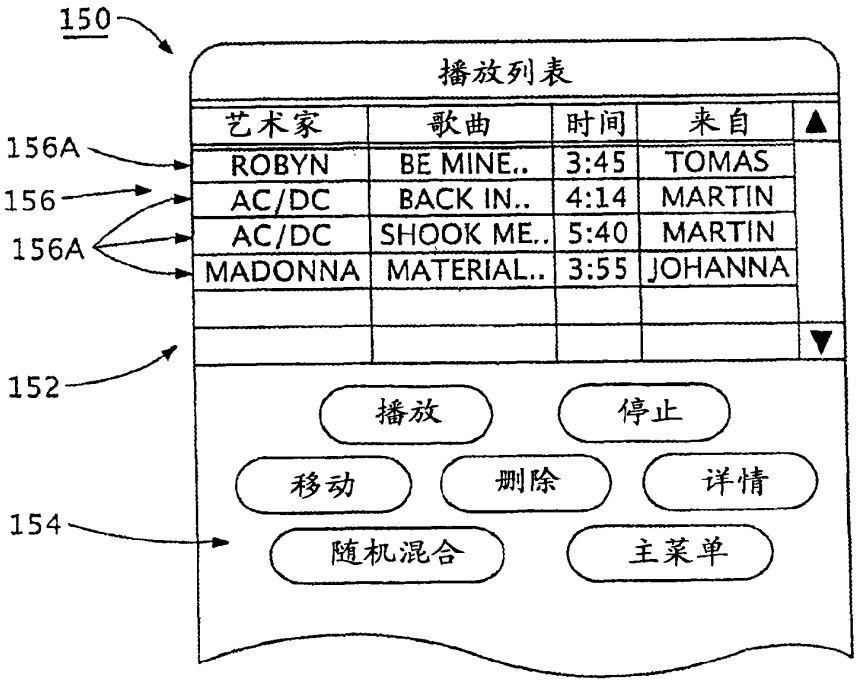


图 4

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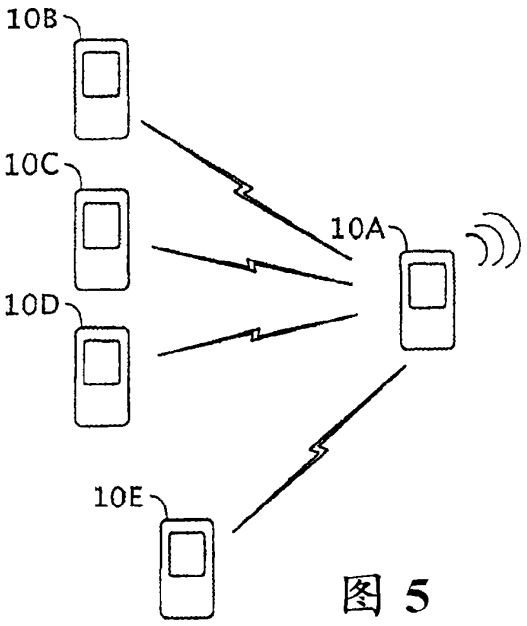


图 5

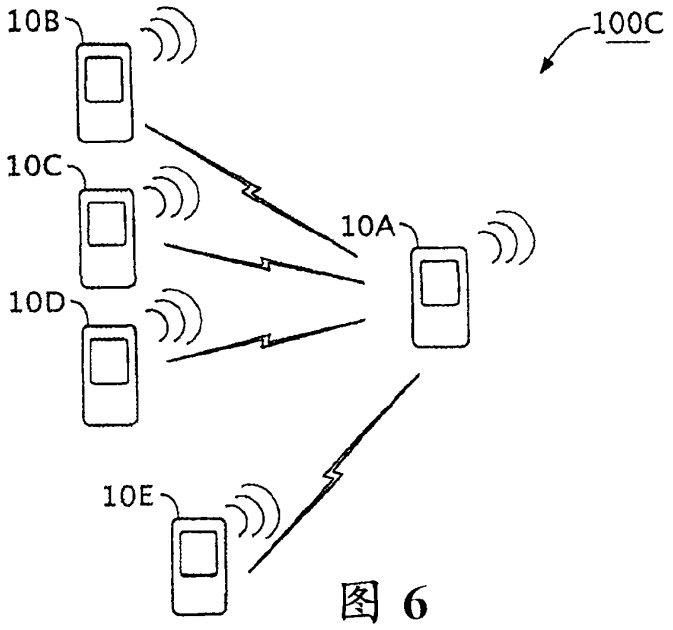


图 6

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Bibliographic data: CN1598767 (A) — 2005-03-23

Method and system for synchronous playing audio-video at BREW platform

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Classification: **- international:** ***G06F17/00; G06F9/44; H04N7/24;*** (IPC1-7): G06F17/00; G06F9/44; H04N7/24

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Abstract of CN1598767 (A)

The invention relates to an approach of synchronous playing audio and video in BREW platform. It includes: setting a data receiving module to connect with network; setting triggering incident of data receiving to receive data from network and storage into data zone; setting an audio playing module to check data in audio data zone, playing audio data and update time stamp of audio playing by using periodic incident to trigger in process of playing audio data; setting a video playing module to check data in video data zone, decode video data, convert video data format to local format, adjust video and audio synchronization, display video data, and what's more, to adjust interval among video frames to realize synchronistically play audio and video data and guarantee its fluency and timely responsibility.

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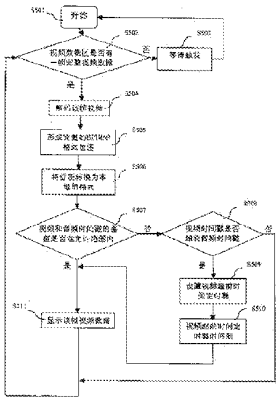
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权利要求书 3 页 说明书 9 页 附图 4 页

[54] 发明名称 在 BREW 平台上同步播放音频视频的方法及系统

[57] 摘要

本发明涉及一种在 BREW 平台上实现同步播放音频视频的方法，包括：设置一数据接收模块，用于与网络建立连接，设置数据接收触发事件，接收来自网络的数据，并存储到数据区；设置一音频播放模块，用于检查音频数据区的数据，播放音频数据，并且在播放音频数据的过程中，利用周期性事件触发定时更新音频播放的时间戳；设置一视频播放模块，用于检查视频数据区的数据、解码视频数据、将视频数据的格式转换为本地格式、调节视频和音频的同步和显示视频数据，还可以进一步调节视频帧间隔，从而实现在 BREW 环境中实现同步播放音频视频数据，并保证其流畅性和及时响应性。



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1. 一种在 BREW 平台上实现同步播放音频视频的方法，其特征在于，所述方法包括：

设置一数据接收模块，用于与网络建立连接，设置数据接收触发事件，接收来自网络的数据，并存储到数据区；

设置一音频播放模块，用于检查音频数据区的数据，播放音频数据，并且在播放音频数据的过程中，利用周期性事件触发定时更新音频播放的时间戳；

设置一视频播放模块，用于检查视频数据区的数据、解码视频数据、将视频数据的格式转换为本地格式、调节视频和音频的同步、显示视频数据 。

2. 根据权利要求 1 所述的在 BREW 平台上实现同步播放音频视频的方法，其特征在于，所述设置一音频播放模块中，当检查音频区，发现音频数据不够播放时，系统转到等待触发。

3. 根据权利要求 2 所述的在 BREW 平台上实现同步播放音频视频的方法，其特征在于，所述等待触发的方式是事件触发或定时器触发。

4. 根据权利要求 3 所述的在 BREW 平台上实现同步播放音频视频的方法，其特征在于，所述事件触发中的事件是数据流接收模块中的数据接收触发事件。

5. 根据权利要求 3 所述的在 BREW 平台上实现同步播放音频视频的方法，其特征在于，所述定时器触发的步骤，包括：

设置音频等待定时器；

音频等待定时器时间到。

6. 根据权利要求 1 所述的方法，其特征在于，所述音频播放的步骤包括：

步骤 61、检查音频数据是否足够播放；音频数据足够时，就转到步骤 63；

步骤 62、设置等待触发的条件，在触发条件满足时，返回步骤 61；

步骤 63、播放音频数据，并且在播放音频数据时，周期性事件触发更新音频播放时间戳。

步骤 64、音频播放完成返回步骤 61。

7. 根据权利要求 6 所述的方法，其特征在于，所述的音频播放步骤还包括，在音频播放部分的开始设置音频播放时间的周期性事件触发，在播放音频数据的过程中，周期性事件触发定时更新音频播放的时间戳。

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8. 根据权利要求 1 所述的方法，其特征在于，所述视频播放步骤包括：

步骤 801、检查是否接收到一帧完整视频数据；接收到一帧完整视频数据时，转到步骤 803；

步骤 802、设置等待触发的条件，条件满足时，转到步骤 801；

步骤 803、解码接收到的视频数据；

步骤 804、形成完整的 BITMAP 格式位图；

步骤 805、将位图转换成为手机本地的格式；

步骤 806、比较视频时间戳和音频时间戳的差值，如果差值在允许范围内，转到步骤 810；

步骤807、比较视频时间戳是否超前音频时间戳，如果是，转到步骤809 ；

步骤 808、返回步骤 801；

步骤 809、设置视频超前定时器，定时器时间到转到步骤 806；

步骤 810、显示该帧数据，返回步骤 801。

9. 根据权利要求 8 所述的方法，其特征在于，在步骤 806 视频时间戳和音频时间戳的差值在范围内，还可以进一步调节视频数据的帧间隔。

10. 根据权利要求 9 所述的方法，其特征在于，所述调节视频数据的帧间隔的步骤包括：

步骤 101、比较视频准确播放时间和当前时间，视频准确播放时间在后，执行步骤 102，视频准确播放时间在前，跳转到步骤 104；

步骤 102、设置差值定时器；

步骤 103、差值定时器时间到；

步骤 104、帧间隔调节完毕。

11. 根据权利要求 1 所述的方法，其特征在于，所述调节视频和音频的同步包括有：

视频时间戳和音频时间戳的差值在允许的范围之内，调节完成；

视频时间戳和音频时间戳的差值在允许的范围之内，调节视频数据的帧间隔，调节完成；

视频时间戳和音频时间戳的差值不在允许的范围之内，并且视频时间戳超前音频时间戳，设置视频超前定时器，定时器时间到，调节完成；

视频时间戳和音频时间戳的差值不在允许的范围之内，并且视频时间戳落后音频

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时间戳，调节完成；

12. 根据权利要求 8 所述的方法，其特征在于，在所述步骤 803、所述步骤 804、步骤 805、步骤 806 之后都可以增加短时定时器，在短时定时器时间到后再执行下一步骤。

13. 根据权利要求 8 所述的方法，其特征在于，步骤 802 所述等待触发的方式是事件触发或定时器触发。

14. 一种在 BREW 平台上实现同步播放音频视频的系统，其特征在于，所述系统包括数据接收模块、音频播放模块和视频播放模块；其中：

数据接收模块，用于实现与网络建立连接，设置数据接收触发事件，接收来自网络的数据，并存储到数据区；

音频播放模块，用于实现检查音频数据区的数据，播放音频数据，在播放音频数据的过程中，利用周期性事件触发定时更新音频播放的时间戳；

视频播放模块，用于实现检查视频数据区的数据、解码视频数据、转换视频数据的格式、调节视频和音频的同步和显示视频数据。

15. 根据权利要求 14 所述的在 BREW 平台上实现同步播放音频视频的系统，其特征在于，所述的触发条件包括事件触发或者定时器触发。

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在BREW平台上同步播放音频视频的方法及系统

技术领域

本发明涉及多媒体通讯技术领域，尤其涉及在 BREW 平台手机上实现同步播放音频视频的方法。

背景技术

BREW 是 Binary Runtime Environment for Wireless 的缩写，是为无线数据应用程序开发和执行提供的通用平台。

BREW 运行时环境是一个较薄的软件接口层，位于芯片系统软件和应用程序间的无线设备上，使最终用户可以无线下载程序并在启用 BREW 的设备上运行。BREW 具有较高的闪存和 RAM 使用效率（即，它所占闪存较少），而且在应用程序运行时动态分配 RAM。BREW 提供一个高效、低成本、可扩展和熟悉的应用程序执行环境(AEE)，一套高度集成的芯片集功能、系统软件以及用于实现高级因特网功能和多媒体功能的插件，着重开发可无缝植入任何实际手持设备的应用程序。BREW 提供的功能环境就如同 PC 机上的操作系统一样，可以通过服务提供商下载指定类型的应用程序或游戏来使用。同时，通过 BREW 接口功能，供应商可以提供成套完整的资讯、商务、娱乐功能。BREW 主要应用在移动通信领域，BREW 类似一个开放免费的 PC 操作系统，厂商可以在这个平台上设计各项应用。

由于 BREW 环境不支持多线程技术和本身平台的特殊性，在 windows 或 Linux 环境下实现多媒体音频视频数据同步播放的方式无法在 BREW 环境中实现，为了实现多媒体的同步播放，必须使用事件技术。

发明内容

本发明所要解决的技术问题在于提供一种在 BREW 平台上同步播放音频视频的方法及系统，实现在 BREW 环境中实现同步播放音频视频数据，并保证其流畅性和及时响应性。

为了实现上述目的，本发明提供了一种在 BREW 平台上实现同步播放音频视频的

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方法，包括 ：

设置一数据接收模块，用于与网络建立连接，设置数据接收触发事件，接收来自网络的数据，并存储到数据区；

设置一音频播放模块，用于检查音频数据区的数据，播放音频数据，并且在播放音频数据的过程中，利用周期性事件触发定时更新音频播放的时间戳；

设置一视频播放模块，用于检查视频数据区的数据、解码视频数据、将视频数据的格式转换为本地格式、调节视频和音频的同步、显示视频数据 。

所述设置一音频播放模块中，当检查音频区，发现音频数据不够播放时，系统转到等待触发。

所述等待触发的方式是事件触发或定时器触发。

所述事件触发中的事件是数据流接收模块中的数据接收触发事件。

所述定时器触发的步骤，包括：

设置音频等待定时器；

音频等待定时器时间到。

所述音频播放的步骤包括：

步骤61、检查音频数据是否足够播放；音频数据足够时，就转到步骤63；

步骤61、设置等待触发的条件，在触发条件满足时，返回步骤61；

步骤63、播放音频数据，并且在播放音频数据时，周期性事件触发更新音频播放时间戳。

步骤64、音频播放完成返回步骤61。

所述的音频播放步骤还包括，在音频播放部分的开始设置音频播放时间的周期性事件触发，在播放音频数据的过程中，周期性事件触发定时更新音频播放的时间戳。

所述视频播放步骤包括：

步骤801、检查是否接收到一帧完整视频数据；接收到一帧完整视频数据时，转到步骤803；

步骤802、设置等待触发的条件，条件满足时，转到步骤801；

步骤803、解码接收到的视频数据；

步骤804、形成完整的BITMAP格式位图；

步骤805、将位图转换成为手机本地的格式；

步骤806、比较视频时间戳和音频时间戳的差值，如果差值在允许范围内，转到

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步骤810；

步骤807、比较视频时间戳是否超前音频时间戳，如果是，转到步骤809 ；

步骤808、返回步骤801；

步骤809、设置视频超前定时器，定时器时间到转到步骤806；

步骤810、显示该帧数据，返回步骤801。

在步骤806视频时间戳和音频时间戳的差值在范围内，还可以进一步调节视频数据的帧间隔。

所述调节视频数据的帧间隔的步骤包括：

步骤101、比较视频准确播放时间和当前时间，视频准确播放时间在后，执行步骤102，视频准确播放时间在前，跳转到步骤104；

步骤102、设置差值定时器；

步骤103、差值定时器时间到；

步骤104、帧间隔调节完毕。

所述调节视频和音频的同步包括有：

视频时间戳和音频时间戳的差值在允许的范围之内，调节完成；

视频时间戳和音频时间戳的差值在允许的范围之内，调节视频数据的帧间隔，调节完成；

视频时间戳和音频时间戳的差值不在允许的范围之内，并且视频时间戳超前音频时间戳，设置视频超前定时器，定时器时间到，调节完成；

视频时间戳和音频时间戳的差值不在允许的范围之内，并且视频时间戳落后音频时间戳，调节完成；

在所述步骤803、所述步骤804、步骤805、步骤806之后都可以增加短时定时器，在短时定时器时间到后再执行下一步骤。

步骤802所述等待触发的方式是事件触发或定时器触发。

本发明还公开了一种在BREW平台上实现同步播放音频视频的系统，所述系统包括数据接收模块、音频播放模块和视频播放模块；其中：

数据接收模块，用于实现与网络建立连接，设置数据接收触发事件，接收来自网络的数据，并存储到数据区；

音频播放模块，用于实现检查音频数据区的数据，播放音频数据，在播放音频数据的过程中，利用周期性事件触发定时更新音频播放的时间戳；

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视频播放模块，用于实现检查视频数据区的数据、解码视频数据、转换视频数据的格式、调节视频和音频的同步和显示视频数据。

所述的触发条件包括事件触发或者定时器触发。

本发明实现在 BREW 环境中实现同步播放音频视频数据，并保证其流畅性和及时响应性。

附图说明

图 1 所示为设置网络数据接收触发事件的流程图；

图 2 所示为数据流接收的流程图；

图 3 所示为音频数据播放的流程图；

图 4 所示为音频定时器触发的流程图；

图 5 所示为视频数据播放的流程图；

图 6 所示为视频定时器触发的流程图；

图 7 所示为调节视频显示帧间隔的流程图。

具体实施方式

以下结合附图和具体实施例对本发明进行详细描述，但不作为对本发明的限定。

由于 BREW 平台不支持多线程技术，在 BREW 平台要实现音视频的同步性要使用基于事件和时间触发的技术，实现如下三大模块的功能：数据流接收模块、音频播放模块和视频播放模块。

数据流接收模块，主要负责接收来自网络的数据。其功能包括：设置网络数据接收触发事件；和在有数据到达后，系统产生数据接收触发事件，随后开始接收数据。

图 1 为数据流接收模块设置网络数据接收触发事件的流程图。

在步骤 S101 中，通过 BREW 平台与服务器相连接。

在步骤 S102 中，设置数据接收触发事件。这可以通过调用函数 ISOCKET_Readable 来设置。

图 2 为在有数据到达 BREW 平台后，接收数据流的流程图。

在步骤 S201 中，有数据到达 BREW 平台。

在步骤 S202 中，系统产生数据接收触发事件。

在步骤 S203 中，开始从网络接收流媒体数据。

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在步骤 S204 中，将接收的数据流中的音频数据放到音频数据区中，视频数据放到视频数据区中。

步骤S205为音频播放和视频播放的开始点。

当有新的数据到达时，BREW 平台会自动产生新的数据接收触发事件，重复执行如图 2 所示的数据接收步骤。

音频播放模块，负责播放音频数据。

图 3 为音频数据播放的流程图。

在图 3 所示的流程图中步骤 S301，即音频数据播放流程的开始点，可以是图 2 所示数据接收流程图步骤S205 的位置 A。

在步骤 S302 中，检查音频数据区的数据是否够播放。是否足够播放的条件是判断音频数据区的音频数据有多少，或音频数据区的数据能够播放多长时间。这个值用户可以自行设定，如够播放 3 秒钟。如果音频数据区的音频数据不够播放，那么跳转到步骤S303；如果数据够播放跳转到步骤S304。

在步骤S303中，系统等待触发事件的到达。当触发条件满足后，跳转到步骤S302，继续检查音频数据区的数据是否够播放。触发的条件可以是事件触发，如数据流接收模块中的数据接收触发事件，也可以是定时器触发。图 4 所示为音频定时器触发的流程图。

在步骤S304中，更新音频时间戳。

在步骤S306 中，播放音频数据。

在步骤S307 中，播放完音频数据后，跳转到步骤S302 继续检查音频数据是否够播放。

在图 3 音频播放流程图的开始位置，可以设置音频播放时间的周期性事件触发，在播放音频数据的过程中，周期性触发事件在触发条件满足后(S305)，更新音频播放的时间戳（S304）。这个时间戳被视频播放模块用作播放时间的参考。例如可以设置音频播放中每播放 500 毫秒的音频数据就触发一个事件。如果没有设置音频播放时间的周期性事件触发，则系统缺省每播放 1000 毫秒的音频数据就触发一个事件。在音频播放的过程中，音频播放的时间戳由于周期性的事件触发被定期的更新。例如，当前时间戳为 1000 毫秒，过 500 毫秒的音频数据就触发一个事件，事件触发后时间戳更新为 1500 毫秒。

图 4 为音频定时器触发的流程图。在图 4 中，设置音频等待定时器（S401），在

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音频等待定时器时间到(S402)后，再去检查音频数据区中是否有足够的数据(S302)。

视频播放模块，负责播放视频数据。

图 5 为视频数据播放的流程图。

在图 5 所示的流程图中步骤 S501，即视频数据播放流程的开始点，可以是图 2 所示数据接收流程图步骤 S205 的位置 A。

在步骤 S502，检查视频数据区的数据是否够一帧完整的视频数据，如果视频区的数据不够一帧完整的视频数据，跳转到步骤 S503 等待触发；如果视频区的数据够一帧完整的视频数据，执行步骤 S504。

在步骤 S503，系统等待触发事件的到达。当触发条件满足后，转到 S502 继续检查视频数据区的数据是否够一帧完整的视频数据。在步骤 S503 中触发的条件可以是事件触发，如数据流接收模块中的数据接收触发事件，也可以是定时器触发。如图 6 所示为视频定时器触发的流程图。

在步骤 S504 中，视频数据区的数据够一帧完整的视频数据，解码这一帧视频数据。

在步骤 S505 中，将解码出来的数据形成一幅完整的 BITMAP 格式位图。

在步骤 S506 中，将步骤 S505 中形成的 BITMAP 格式位图转换为手机本地的格式。

在步骤 S507 中，计算视频时间戳和音频时间戳的差值，判断音频当前播放的时间戳和该视频帧的时间戳的差值（也称上述差值为同步误差）是否在允许的范围内。例如视频时间戳和音频时间戳差值的允许范围可以设置为正负 100 毫秒之间。

当视频时间戳和音频时间戳的差值不在允许的范围内时，转到步骤 S508，判断视频时间戳是否超前音频时间戳。视频时间戳超前音频时间戳时，根据视频时间戳和音频时间戳的差值设置视频超前定时器（S509），视频超前定时器时间到时（S510），从而保证同步误差在允许的范围内；视频时间戳落后音频时间戳时，显示该帧视频数据已经没有意义，丢弃该视频数据，然后转到 S502 继续检查视频数据区是否有一帧完整的视频数据。

当视频时间戳和音频时间戳的差值在允许的范围内时，显示该帧视频数据(S511)然后转到步骤 S502 继续检查视频区是否有一帧完整的视频数据。

在如图 6 中，首先设置视频等待定时器(S601)，在视频等待定时器时间到(S602)后，检查视频数据区中是否有一帧完整的视频数据（S502）。

在步骤 S504、步骤 S505、步骤 S506、步骤 S507 之后可以增加短时定时器，在短

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时定时器时间到后再执行下面的步骤。例如在步骤 S504，即解码该帧视频后，设置10 毫秒的短时定时器，在 10 毫秒时间到后再执行步骤S505 形成完整的BITMAP 格式位图。这样可以使手机在播放视频音频流的时候依然可以及时相应用户的按键请求等。

为了使视频播放更加流畅，不仅要求音频数据和视频数据的同步误差在允许的范围内，还要求任何两帧视频之间的时间间隔基本一致。为了达到上述目的，当同步误差在允许范围内时，还可以进一步调节帧间隔显示该帧视频数据。

在音频视频同步的情况下，视频准确显示的时间等于上一帧显示的时间加上帧间隔时间。帧间隔时间等于帧率的倒数。例如每秒显示 5 帧视频数据，帧间隔时间是 200 毫秒。在实际播放中，很能难保证两帧显示之间的时间差绝对准确地等于帧间隔时间，因此，可以设定视频帧间隔时间误差（称为帧间隔误差）允许范围。当两帧之间的帧间隔误差在允许的范围内时，认为两帧视频之间的时间间隔基本一致，即两帧视频的播放是流畅的。例如设置帧间隔误差允许范围为±10%，即当两帧显示的时间差在 200 毫秒时，允许的误差范围为正负 20 毫秒。

图 7 为调节视频显示帧间隔的流程图。

在图 7 中，首先视频时间戳和音频时间戳的差值在允许范围内（S701）；判断当前时间是否超前于视频准确播放时间（S702），当前时间落后于视频准确播放时间时，直接显示此帧视频数据（S705）；当前时间超前视频准确播放时间时，设置差值定时器（S703），差值定时器时间到（S704），显示此帧视频数据（S705）。显示此帧视频数据（S705）后，记录播放时间戳（S706）。在图 7 中，步骤S702、S703、S704、S705、S706 共同构成帧间隔调节模块 B。

在步骤S703 中设置的差值定时器的差值满足如下两个条件：

条件一、同步误差在允许范围内；和

条件二、帧间隔误差在允许范围内。

条件一可以保证视频数据和音频数据同步；条件二可以保证视频数据帧间隔基本一致，从而得到流畅的视频效果。

在视频播放的过程中，若选择调节帧间隔，那么可以用图 7 中的帧间隔调节模块 B 取代图 5 中的步骤 S511，并且当视频时间戳落后音频时间戳时，转到步骤 S706 之前，记录视频播放时间戳，从而在 BREW 环境中实现同步播放音频视频数据。

下面是在以 BREW 平台为基础的手机上，应用本发明的方法播放音频和视频的另

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一个实施例。

首先手机与服务器相连接，然后调用系统函数，设置网络数据接收触发事件。

当来自服务器的数据流到达手机的 BREW 终端后，系统会产生数据接收触发事件，随后开始接收数据。系统分配两个数据区，一个为音频数据区，一个为视频数据区。对到达 BREW 终端的数据流进行分析，将视频的数据放到视频数据区，音频数据放到音频数据区。

例如设置足够播放的条件为音频数据区的数据能连续播放 5 秒钟。检查音频数据区的数据是否足够播放。检查结果发现音频数据区的数据仅仅能播放 3 秒钟，设置音频等待定时器为 2 秒钟。在 2 秒钟音频定时器时间到后，再次检查音频数据区的数据是否足够。检查结果音频数据区的数据能够播放 5 秒。

播放音频数据区的数据。播放完成，则继续检查音频数据区是否有足够的音频数据。

在音频播放的开始设置音频播放时间的周期性事件触发，例如每播放 500 毫秒的音频数据就触发一个事件。在播放音频数据的过程中，音频播放的时间戳由于周期性的事件触发被定期的更新，如现在的时间戳为 1000，经过 500 毫秒的音频数据就触发一个事件，触发后，时间戳更新为 1500，再过 500 毫秒，时间戳更新为 2000。

视频播放时，先检查视频数据区的数据是否够一帧完整的视频数据，如果不够，等待触发。触发条件在此选用定时器触发。例如设置视频等待定时器 1 秒钟。在 1 秒钟后，再去检查数据是否足够。

视频数据区的数据够一帧完整的视频数据后，就调用解码器解码这一帧视频。解码出来的数据通过色彩空间转换变为RGB24位的色彩空间，在内存区组织形成一幅完整的BITMAP格式位图内容，再将该位图转换为手机本地的格式。

随后要比较同步误差是否在允许的范围之内。例如同步误差的允许范围设置为正负100毫秒内。若音频的时间戳是2000，视频的时间戳是2050，那么就可以直接显示该帧视频数据。

如果同步误差不在允许的范围内，就要判断视频时间戳是否超前音频时间戳。当视频时间戳超前音频时间戳时，例如，音频的时间戳是2000，视频的时间戳是2150，即视频超前（2150－2000）＝150毫秒，此时设置150毫秒的定时器，在该定时器时间到后，再显示该帧视频。

当视频时间戳落后音频时间戳时，例如，音频的时间戳是2000，视频的时间戳是

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1850，在这种情况下，显示该帧视频数据已经没有意义，因此丢弃该帧数据。

为了使视频播放更加地流畅，需要进一步调节帧间隔。

例如，在BREW终端上设置每秒5帧视频图像，帧间隔时间是200毫秒，设定帧间隔误差范围±10%，即允许两帧显示的时间差在200毫秒正负20毫秒之间。

当第N帧视频播放的时间是2050，则第(N+1)帧视频的准确播放时间应该是2250。若当前视频的时间戳是2230，那么视频帧超前20毫秒，帧间隔误差在误差允许的范围（±20 毫秒）之内，因此可以直接显示当前帧的视频数据。或当前视频的时间戳是2220，那么视频帧超前 30 毫秒，帧间隔误差超过了误差允许的范围，则需要设置差值定时器的值为 30 毫秒，以调节帧间隔，从而保证播放的视频图像流畅。在差值定时器时间到后，显示该帧视频。若当前视频的时间戳是2260，表示已经落后于准确显示时间，则直接显示该帧视频。显示完该帧视频数据后，记录视频时间戳的值。

在解码该帧视频、形成完整的BITMAP格式位图、将位图转换为手机本地的格式和显示该帧视频这四个步骤之后增加10毫秒的定时器，在10毫秒到后再继续执行下面的步骤。这样可以使手机在播放视频音频流的时候依然可以及时响应用户的按键请求等。

在处理完一帧数据之后，继续检查视频数据区的情况。

当然，本发明还可有其他多种实施例，在不背离本发明精神及其实质的情况下，熟悉本领域的技术人员当可根据本发明作出各种相应的改变和变形，但这些相应的改变和变形都应属于本发明所附的权利要求的保护范围。

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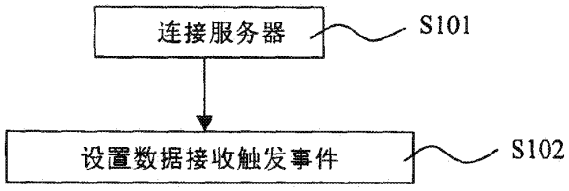


图 1

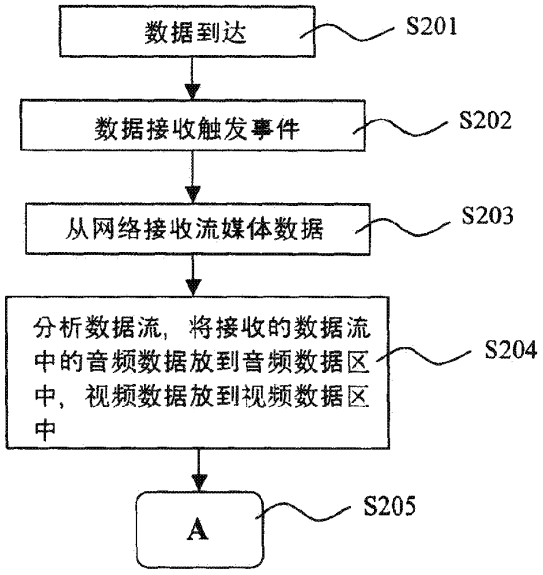


图 2

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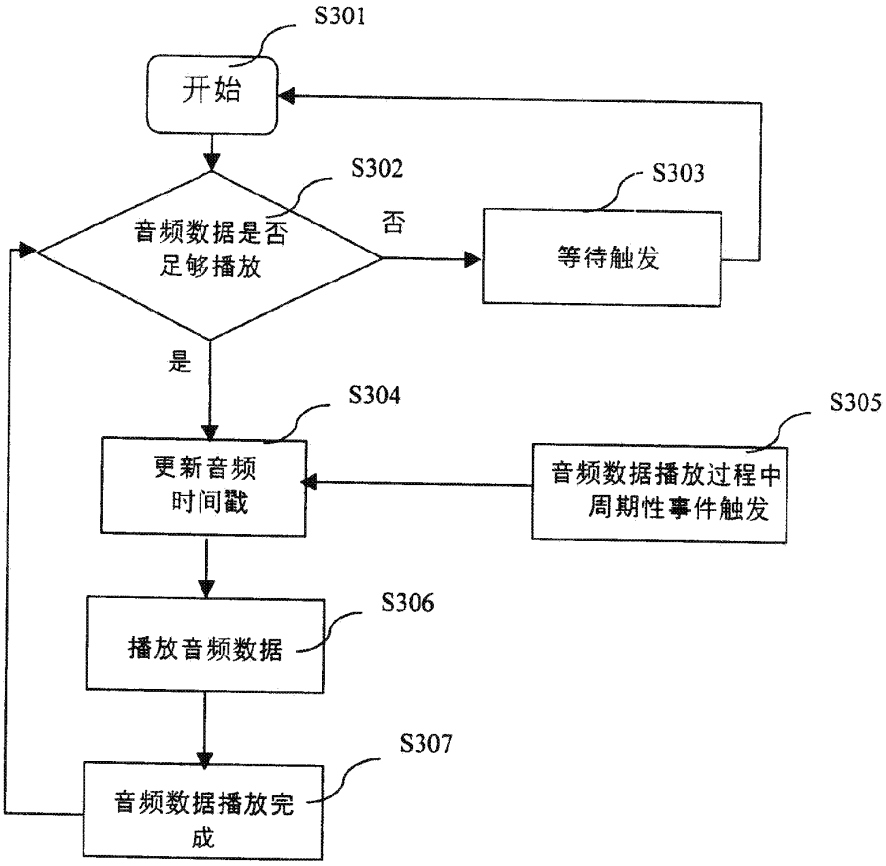


图 3

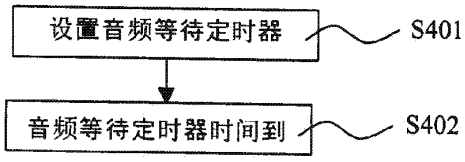


图 4

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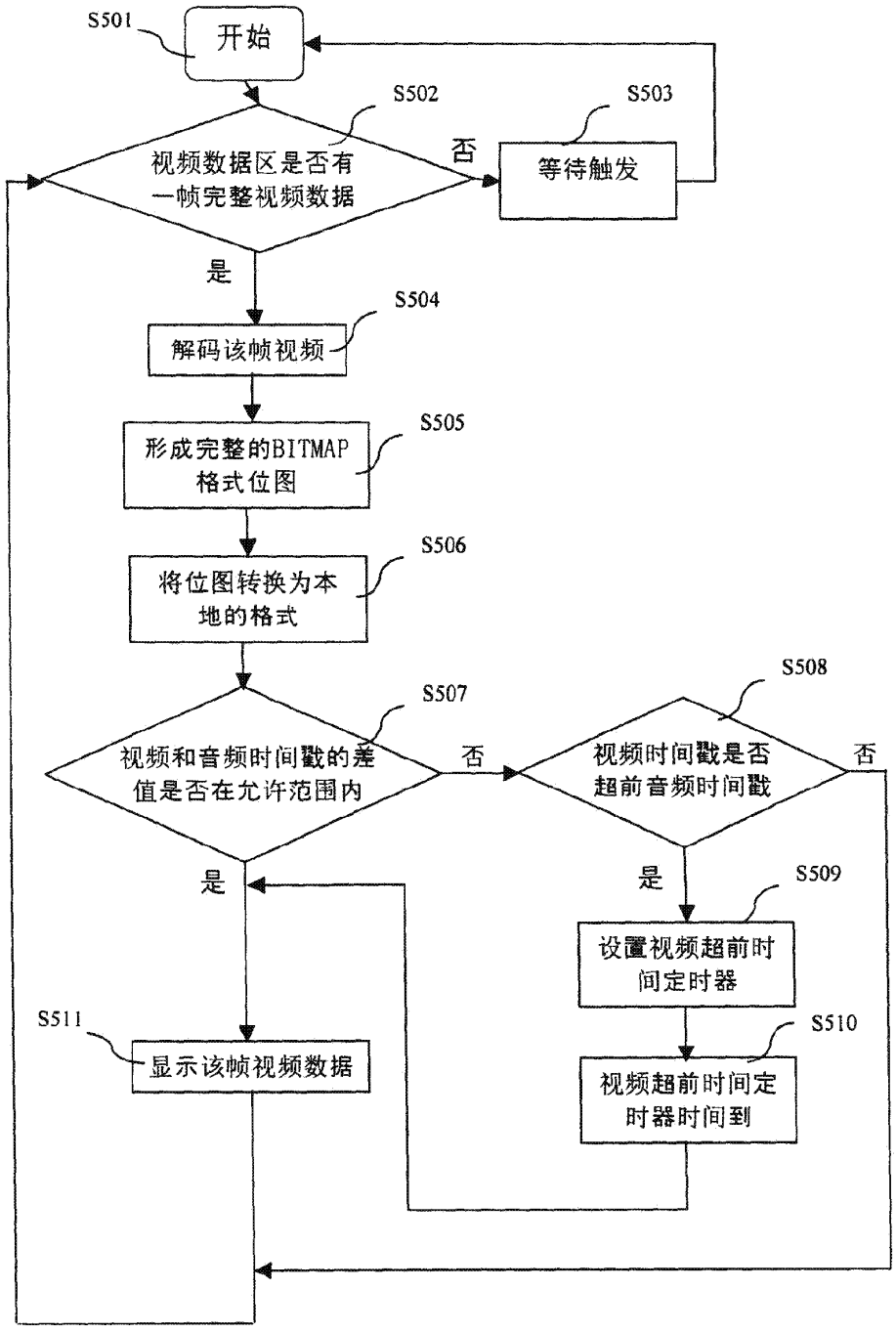


图 5

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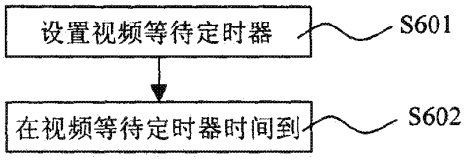


图 6

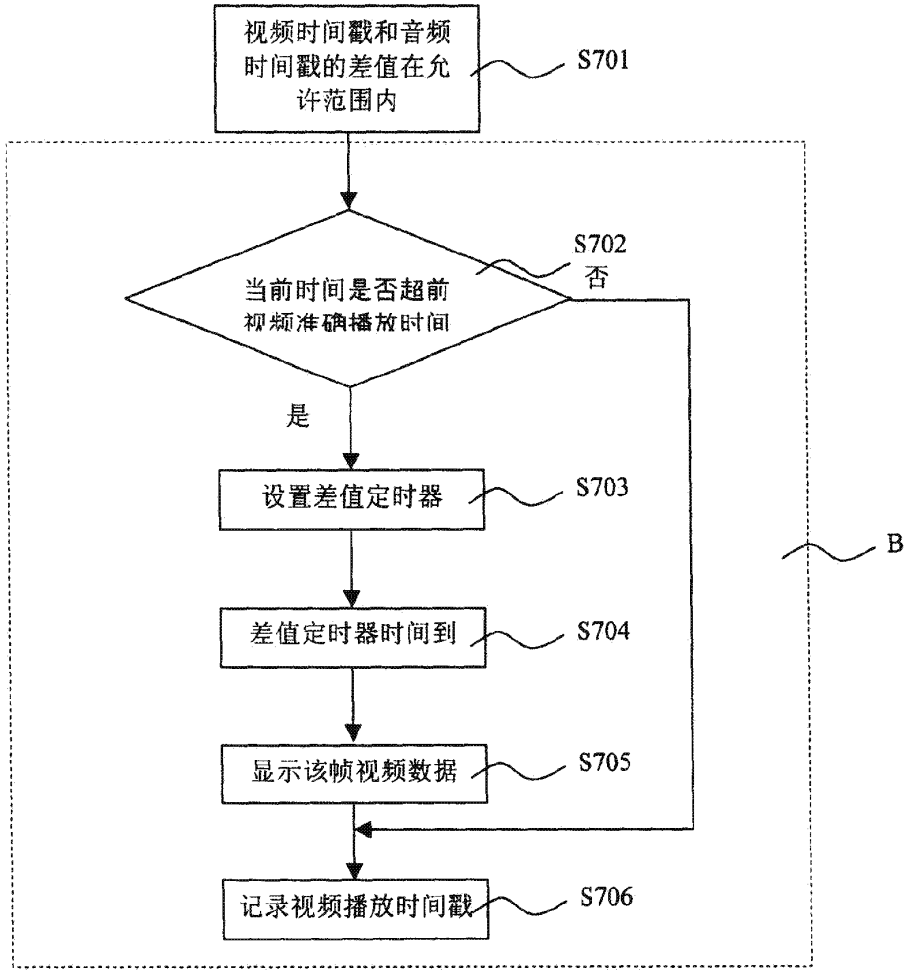


图 7

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(54) **A synchronization service for a distributed operating system or the like.**

(57) A synchronization service which can be incorporated into a distributed operating system as a shared service. It allows the realization of different custom-built synchronization strategies for different applications. This approach is based on defining a general set of application-independent synchronization primitives. These are provided by the distributed operating system in the form of a synchronization service. By themselves the individual primities are insuffient to provide synchronization. However, they can be combined in different ways to realize customized synchronization strategies. This leaves the ultimate responsibility for synchronization with the application, but in a much simplified form. Application programs can combine these primitives to construct the most suitable form of synchronization.

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A SYNCHRONIZATION SERVICE FOR A DISTRIBUTED OPERATING SYSTEM OR THE LIKE

This invention relates generally to the field of computers, and more specifically to a synchronization service for use with computers.

Background of the Invention

As computing tasks increase in size and complexity, one approach to speed up the execution of these tasks is to use distributed programs. A distributed program can be defined as a computer program which is partitioned into multiple concurrent components which execute on separate processing sites which do not share a common memory.

In this context, the term "program" is used to imply a global objective (i.e. common goal). Each component (or portion) of the program performs some portion of the overall activity required to attain this common goal. Thus, a distributed program represents a set of (functionally) tightly-coupled components operating in a (physically) loosely-coupled environment.

Asynchronous operation of concurrent cooperating activities results in the time-dependencies and race conditions which can lead to errors. For example, two processes attempting to simultaneously update a shared variable may interfere with each other so that an incorect value is assigned to the variable. The solution to such problems is through synchronization. Synchronization can be defined as the organization of actions and interactions of a system of concurrent asynchronous entities for the purpose of achieving some common objective.

One example of a distributed computer system is the case of a replicated database where each copy of the database is on a separate processing element. When a change is made to one copy then this change must be propagated to all the others if consistency is to be maintained. This involves synchronization. The situation may be complicated further if two or more conflicting changes are initiated simultaneously on different copies. In that case synchronization is required not only to ensure that all copies end up in the same state but also that the resulting state is valid. Other situations where synchronization is necessary include the restoration of the current state to new or recovering copies and the handling of failures.

Distributed synchronization can also be useful in standby schemes where redundant components are configured for greater system availability. In this case the compnoents have to agree as to which will be the active and which the standby components and must also arrange for proper switchover in case of failures.

The cited examples illustrate the diverse ways in which synchronization is used in distributed systems. As can be expected, different applications can have different demands on synchronization: some may require fast response while others may place more emphasis on reliability and fault tolerance. This indicates that the choice of the most suitable synchronization technique and tis implementation can only be made if the particular needs of the application are considered.

Unfortunately, in a large system supporting many different types of distributed application programs, leaving synchronization entirely to the application program could result in excessive duplication of effort, unreliable design, and suboptimal utilization of resources. Even worse, perhaps, is the possibility that the relatively complex issue of synchronization could dominate the design to such an extent that functional concerns are neglected. From that point of view a trusted, system-based, synchronization facility is preferred.

There are several important characteristics of distributed programs which make them significantly more difficult to design and implement compared to conventional non-distributed programs:

(1) Concurrent execution. This means that there is no single sequential control thread such as represented by the execution trace of a non-distributed program. Concurrency introduces timing dependencies among the system components which can lead to deadlocks or instability.

(2) Significant communication delays. The exchange of information between components of a distributed program involves non-negligible and randomly-distributed transmission delays. If these delays are comparable to the rate at which the components change state, the system may become unstable.

(3) Partial failure modes. Failures of distributed components require complex detection and recovery algorithms which are difficult to design and verify. Two types of partial failures exist:

- Communication path failures can result in the duplication, temporal reordering, or total loss of information being exchanged; and
-Processing component failures (hardware and software) lead to temporary loss of functionality.

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The recovering action for each type of failure is quite different. Unfortunately, it is often difficult to distinguish them on the basis of the observed symptoms.

From the definition of synchronization it can be seen that the need for synchronization is determined by the shared objective of the cooperating distributed entities. This common objective places interdependencies on the individual entities so that a change in the state of one necessitates appropriate changes (reactions) in others. This can be expressed as a requirement to preserve certain application-dependent state consistency constraints. The problem of maintaining consistency is further complicated by the fact that each entity, in addition to internal interactions, is also exposed to independent interactions with the environment. (The environment consists of other distributed components which do not share the same objective as the synchronized system, but which use it for their own purposes). This means that the stimulus to change state can occur simultaneously in two or more synchronized entities. The synchronization problem can then be viewed as one of ordering concurrent interdepenent activities.

The simplest form of ordering which guarantees consistency is serialization: the execution of activities one at a time. Although synchronization strategies exist which are not based on serialization, they will not be considered here due to their relative complexity.

Two basic, and not necessarily exclusive, classes of strategies exist for achieving serialization in distributed systems;

(1) Centralized strategies.

In this case, the ordering of activities is performed by a unique distinguished entity. Synchronized entities, with externally induced work requests, first approach the distinguished entity for permission. This entity resolves concurrent requests by granting a right to only one of the competing entities. When that entity completes its work, the right is granted to another entity, and so on.

A major feature of this type of scheme is that there is a single point of control. This allows the implementation of relatively complex yet reliable and efficient scheduling algorithms. Examples of centralized strategies can be found in A Decentralized Control Method in a Distributed System by J.P. Cabanel et al, Proceedings 1st Ceonference, Distributed Proc. Systems, Huntsville, Al, 1979 and in A Failure Tolerant Centralized Mutual Exclusion Algorithm by G. N. Buckley et al, Proceedings 4th Conference, Distributed Computer Systems, San Francisco, Ca. 1984.

(2) Distributed strategies.

In this case, there is no central scheduler. Instead, ordering is accomplished through distributed agreement. Key to this scheme is a shared "clock" (logical or physical). This is generally a monotonically increasing numeric variable which is maintained consistently by all the synchronized entities. Work requests are timestamped with the clock value at the time of arrival and then processed in order. However; because two or more requests can be concurrent (i.e., they have the same timestamps), ties are resolved through group negotiation: a new work request is first broadcast to all other entities which respond either with a simple acknowledgement or a work request of their own. Once an entity is aware of all concurrent work requests within the group, it orders them according to some tie-breaking rule and then processes them. Since each entity uses the same ordering algorithm each will perceive the same sequence of events as all the others.

The distinguishing feature of distributed strategies is that operation does not depend on a single critical entity at any time. This makes them very fault-tolerant. However, they are generally less efficient than centralized strategies when the number of entities to be synchronized is large. Examples of distributed strategies can be found in Time, Clocks, and the Ordering of Events in a Distributed System by L. Lamport, Comm. ACM, (21,7), July 1978, in An Algorithm for Maintaining the Consistency of Multiple Copies by D. Herman et al, Proceedings, 1st Conference Distributed Proc. Systems, Huntsville, Al., 1979 and in Synchronization in Distributed Programs by F.B. Schneider, ACM Transactions on Prog. Lang. & Syst, (4,2), April, 1982.

Combinations of these two forms, such as the circulating sequencer proposed in Algorithms for Distributed Data Sharing Systems Which Use Tickets by G. Le Lann, Proc. 3rd Berkeley Workshop on Dist. Data, Aug. 1978, are possible. In that scheme, a centralized controller is used to control the clock used for timestamping. (Although the controller function is circulated among the distributed entities, at any given time it is performed by only one entity.) The ordering of activities is then done in a distributed fashion, based on timestamp values and a tie-breaking rule.

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The following patents depict examples of distributed processing in general, and attention is directed to them: U.S. patent 3,411,139 dated November 12, 1968 by J.T. Lynch et al; U.S. patent 3,631,405 dated December 28, 1971 by G.S. Hoff et al; U.S. patent 3,771,137 dated November 6, 1973 by R.P. Barner et al; and U.S. patent 4,115,866 dated September 19, 1978 by J.L.G. Janssens et al.

Summary of the Invention

One objective of the Synchronization Service of the present invention is to provide a set of application-independent capabilities which would allow the construction of specific synchronization strategies belonging to the categories listed above. To do this it must incorporate the essential abstract features of those strategies. These are defined in the form of a general synchronization paradigm described in a following section.

Because of concurrent execution and the possibility of partial failures, it is necessary to closely synchronize the operation of the distributed components of a program. Synchronization can be defined as the ordering of actions and interactions of components in a distributed program so that the state of each component remains consistent with the common goal.

Experience with concurrent systems has shown that the synchronization problem is difficult to solve even for non-distributed situations; the number of possible component interactions is usually very large, increasing the probability of a design error.

A further difficulty is caused by the fact that no single synchronization strategy is adequate for all distributed programs. If multiple distributed programs are to be supported on a system, this means that the synchronization problem may have to be solved in many different ways.

Given the diversity of synchronization strategies and the difficulty of implementing them, is it possible to provide some assistance to designers of distributed programs to increase the reliability of their designs?

The approach to this problem, presented by the present invention, consists of providing a set of primitive synchronization operators at the level of a distributed operating system. Such operators can be used to construct more complex forms of synchronization customized to different applications. This approach has the following advantages:

-It provides a one-time trusted implementation of common mechanisms;

-It does not favour any particular synchronization strategy which would favour some applications but penalize others;

-It provides a systematic framework (programming model) for designing and implementing distributed programs.

The operating system component which implements the synchronization primitives (operators) is called the Synchronization Service.

The essential idea behind the Synchronization Service is that the synchronization problem can be tackled hierarchically. Each level in the hierarchy may have different synchronization mechanisms based on the synchronization facilities of the levels below. The lower levels of this hierarchy can be designed to be application-independent and can therefore be provided as a reliable system service. This, in turn, increases the reliability of programs and reduces development time.

This approach to distributed synchronization attempts to decompose the synchronization problem. At the lowest level of decomposition a general set of application-independent synchronization primitives is defined. These are provided by the distributed operating system in the form of a synchronization service 10. By themselves the primitives are insufficient to provide synchronization. However, they can be combined in different ways to realize customized synchronization strategies. This leaves the ultimate responsibility for synchronization with the application program, but in a much simplified form. The role of the synchronization service 10 is to hide many of the more basic housekeeping functions inherent in distributed synchronization. For instance, all fault-tolerant synchronization schemes require a monitoring function to keep track of the operational status of all relevant distributed components. The present invention consolidates such a function as a system service where it can be shared by many application programs.

Stated in other terms, the present invention is a general service, provided within a distributed operating system, which can be used by application and system programs to implement synchronization between program components that are physically distributed.

Stated in other terms, the present invention is a synchronization service for use with a computer having a distributed operation system, to allow the construction of a customized synchronization scheme, for synchronizing the constituent portions of a distributed program, the service comprising: a general set of application-independent synchronization primitives, whereby the construction of the customized synchronization scheme is achieved by the selective implementation of the application-independent synchronization primitives.

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Stated in yet other terms, the present invention is a synchronization service for use with a computer having an operating system distributed over a plurality of processing elements, to allow the construction of a customized synchronization scheme, for synchronizing the constituent components of a distributed program, the service comprising the steps of:

a) joining a program component on a fist processing element to a group of existing program components on at least a second processing element so that each of the existing components is aware of the present and location of the joining components;

b) informing each member of the group of physically distributed program components when one or more components which are members of the group, depart from it;

c) selecting, as a distinguished member, one program component from a group of distributed program components such that, within the group, there is never more than one distinguished member; and

d) providing mutually exclusive rights to the group of distributed program components such that no more than one component can appropriate a given right at any time.

Stated in still other terms the present invention is a synchronization service, for use with a computer having an operating system distributed over a plurality of processing elements, to allow the construction of customized synchronization schemes for synchronizing the constituent components of a distributed program, the service including a synchronization master control comprising: master control means for activating the synchronization service; polling means for polling the processing elements associated with the components of the distributed program so as to monitor the status of the processing elements; control means for joining new members to the group, and for handling departures of members from the group; and a database means containing information representative of the current state of the synchronization service at a given point in time.

Brief Description of the Drawings

The present invention will now be described in more detail with reference to the accompany drawings, wherein like parts in each of the several figures are identified by the same reference character, and wherein:

Figure 1 depicts a simplified block diagram of the synchronization service of the present invention;

Figure 2a is similar to Figure 1 but is for one specific embodiment thereof;

Figure 2b is a variation on the embodiment of Figure 2a;

Figure 2c is similar to Figure 2b;

Figure 3a is a chart depicting the primitives and corresponding replies employed by the invention;

Figure 3b is a symbolic representation of the constituent tasks of synchronization master control of Figure 1;

Figure 3c is a symbolic representation of the constituent tasks of member agent 11 of Figure 1;

Figure 4 is a simplified functional flow diagram for a database;

Figure 5 is a simplified functional flow diagram for a database;

Figures 6 to 8, 9a, 9b, and 10 to 13 inclusive represent action sequences helpful for understanding the operation of the present invention; and

Figure 14 is a simplified representation of the useage dependencies helpful in understanding the operation of the present invention.

Detailed Description

Synchronization service 10 is based on a general distributed program paradigm. This paradigm is represented by the concept of synchronization groups. A synchronization group is a set of distributed program components called "members", and referred to by the reference character 18, which cooperate to achieve a common objective. Note that members 18 are not a part of synchronization service 10, but they use synchronization service 10.

In other words, the distributed operating system 15, to which synchronization service 10 is applied, will support both distributed application programs and distributed system programs. Both the distributed application and system programs consist of several program components (called members 18) which in turn consist of subcomponents called tasks. In synchronization service 10 there is one synchronization group for each distributed application or system program.

A primitive synchronization operator has effect only within the domain of a particular synchronization group. Synchronization groups, therefore, encapsulate units of tightly coupled distributed functionality. Of course, synchronization service 10 allows many synchronization group to coexist on a single distributed operating system 15.

The basic construct of synchronization service 10 is the synchronization group representing a set (i.e., a system) of distributed entities which are tightly coupled to each other in some way. The

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state and action dependencies which bind these entities are not specified at this level so that synchronization groups are decoupled from application semantics.

Formally, a synchronization group is a set of components, called members 18, in which each group ideally has the following properties:

(1) Uniqueness: There can be any number of synchronization groups in a larger system but each synchronization group is distinguished from all others by a unique synchronization gruop identifier.

(2) Physical distribution: Each member of a synchronization group exists on a different processing element 12. (This is simply a matter of convenience: extending the concept of synchronization groups to logically distributed entities is possible). Note that there are no restrictions concerning the number of synchronization groups which may have members 18 on a particular processing element 12. This means that two or more synchronization groups can overlap in physical space.

(3) Reliable communication: Communication between any pair of members 18 is non-lossy, non-duplicating, and order-preserving. Furthermore, full connectivity is assumed; i.e., each member 18 can communicate directly with all other members 18. If the physical system does not have these properties then it is assumed that an underlying communication service exists which provides them. The intent here is to isolate communications issues from synchronization issues.

(4) Dynamic behavior: Members 18 can depart or join the synchronization group at any time and independently of each other. (The group exists as long as at least one member 18 exists.) Departures may be either application-driven or due to processing element 12 failure. This property captures the dynamic nature of real-world components.

(5) Mutual exclusion: Each synchronization group maintains a set of shared objects called rights, each of which can be either free or associated with at most one member 18. They are functionally equivalent to semaphores (reference: E.W. Dijkstra, Cooperating Sequential Processes, Technical Report EWD-123, Technological University, Eindhoven, 1965) but for a distributed environment. (However, a member 18 can hold more than one right at a time.) A departing member 18 cannot abscond with a right since any rights it holds are automatically freed. In essence, rights are a general mechanism for distinguishing between group members 18. The assignment of functional significance to rights is up to the application.

(6) Distinguished member: One and only one member 18 of every synchronization group is designated as its distinguished member. The appointment is made at random and is transferred to another member 18 if the current distinguished member 18 departs. This property is intended to serve those synchronization strategies which require a central coordinator although synchronization service 10 makes no assumptions regarding the functional significance of the distinguished member 18. (Note that the distinguished member feature is simply a special case of the mutual exclusion property but has been singled out purely for convenience.) Since the selection and preservation of a distinguished member 18 is by synchronization service 10, application programs need not implement their own election algorithms.

A synchronization group represents a unit of synchronization. The facilities of the synchronization service 10 (described later) are all limited in scope to the respective synchronization group.

The synchronization problem is often formulated as a problem of maintaining data consistency in a dynamic environment. From that point of view, the synchronization service 10 ensures consistency of the folowing information sent to members 18:

(1) current membership list;

(2) the identity of the distinguished member; and

(3) the status of all group rights.

This information is maintained consistently and correctly in the face of continual departures and arrivals of members 18.

The concept of synchronization groups does not encompass application program-level consistency; that is the responsibility of the application program. Instead, a synchronization group maintains a consistent view (on all its members 18) concerning the status of its objects: the list of active members 18, the status of rights, the distinguished member designation. These responsibilities are therefore removed from the view of the application program.

Figure 1 depicts a simplified block diagram of synchronization service 10 of the present invention. A distributed application program, structured as a synchronization group, typically has members 18 (i.e. distributed program components) which are physically distributed across two or more processing elements 12a....12n (referred to collectively as processing elements 12). In the implementation of Figure 1, the structure of synchronization service 10 matches the structure of the synchronization group by providing a local synchronization controller, i.e. member agent 11, for each group member 18. Thus, there is a separate implementation of synchronization service 10 for each application program; note, however, that there is only one synchronization master control 13 regardless of how

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many implementations, and only one synchronization agent 14 per processing element 12. Each implementation is functionally independent of the others.

Note that the group of processing elements 12 together with processing element 19 form part of the distributed computing environment (i.e. distributed operating system 15) which synchronization service 10 is designed to synchronize. Not also that each processing element 12 may have a plurality of member agents 11, and that processing element 19 may be combined with one of the processing elements 12.

Member agents 11 provide the main interface to the synchronization service 10. Application program components (i.e. members 18) initiate synchronization activities by invoking the desired synchronization primitives (to be described later). This is communicated to the local member agent 11 which then interacts with other member agents 11 in order to effect the specified synchronization function. The member agent 11 also informs the members 18 of synchronization requests initiated by other members 18 as well as group events such as the failure of active members 18 and the joining of new ones.

Member agents 11 are dynamic entities which follow the dynamics of the application programs they serve. A member agent 11 is created (by the local synchronization agent 14) when an application program component (i.e. member 18) requests to be synchronized with other members 18 in a synchronization group. It is destroyed when the member 18 is unsynchronized.

To ensure coherent behaviour of synchronization service 10, control of the individual implementations of the service 10 is centralized. This is done through a three-level hierarchy with a unique master controller at the top (i.e. synchronization master control 13), an intermediate layer of controllers in the middle (i.e. synchronization agents 14a to 14n, referred to collectively as synchronization agents 14), and a layer of member agents 11 at the bottom. This hierarchy allows a decomposition of the control problem into smaller more comprehensive subproblems. Note from Figure 1 that there is one synchronization agent 14 for each processing element 12, and it controls all the member agents 11 in that processing element 12.

Figure 2a is similar to Figure 1, but depicts a specific embodiment of the synchronization service, referred to by reference character 100 as applied to distributed operating system 115. In Figure 2a there is a synchronization master control 13 on processing element 119, three processing elements 112a, 112b, and 112c, three synchronization agents 14a, 14b, and 14c, along with six members 18a to 18f along with their corresponding member agents 11a to 11f respectively. In the distributed computing example of Figure 2a, processing elements 112a, 112b, 112c and 119 are each an IBM PC-AT. Note that the members 18a to 18f inclusive are not part of synchronization service 100 while everything else shown in Figure 2a is. Members 18a to 18f inclusive use the synchronization service 100. Note also that there is another synchronization master control (not shown) on standby.

Figure 2b is similar to Figure 2a, but is further simplified and depicts only those items that constitute one implementation of synchronization service 100 (i.e. implementation 100a). That is, members 18a and 18e (Figures 2a and 2b) form one synchronized group. Members 18b, 18c, 18d, and 18f (Figure 2a) form at least one other synchronized group.

Figure 2c is a simplified application to exemplify synchronization service 100a of Figure 2b. In Figure 2c the hardware implementating synchronization service 100a is a group of IBM personal computers of the AT series, linked by an IBM LAN (local area network) 226. That is, processing element 112a is an IBM PC-AT computer 212a, processing element 112b is an IBM PC-AT computer 212b, and processing element 119 is an IBM PC-AT computer 219.

In Figure 2c, computer 212a is a telephone operator's workstation as is computer 212b. The application in Figure 2c is to maintain a telephone directory and to allow the user at both computers 212a and 212b to have access to the telephone directory, to access it to determine an individual's telephone number, and to be able to update the telephone directory as changes occur. Computer 219, in this example, handles the tasks of synchronization master control 13 and database 16 (Fig. 2b)

Returning now to the general case of Figure 1, the role of synchronization master control 13 is to provide internal synchronization between the components of the local synchronization service 10. In essence, it performs those functions where a consistent (but not necessarily correct) view of the system 15 is required. More precisely, synchronization master control 13 is responsible for:

(1) Activation of synchronization service 10.

This is done by activating the synchronization agents 14 as the processing elements 12 are restarted.

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(2) Monitoring of processing elements 12.

This function involves observing (polling) the status of all processing elements 12 by communicating with local synchronization agents 14. Any changes in these states are detected by synchronization master control 13 and appropriate notifications are dispatched to the synchronization service components affected by the change.

(3) Management of synchronization groups.

synchronization master control 13 is the central arbiter for all synchronization groups in the local synchronization service 10. It is involved in handling transient conditions which occur in group operation:
-group establishment,
-joining of new members 18, and
-departures of joined members 18.
Note that synchronization master control 13 does not participate in the steady-state operation of synchronization groups and, consequently, is not normally a performance bottleneck.

Synchronization master control 13 must be highly fault-tolerant since synchronization service 10 may be used to implement standby schemes by applications. For that reason it is backed up by at least one other instance operating in standby mode. If the currently active synchronization master control 13 fails, the standby will take its place. Because this is the Synchronization Service, the selection of an active synchronization master control 13 from the set of instances must be done through an internal agreement (election). This is the only place in the entire system where the synchronization service 10 cannot be used for such a purpose. However, in this case, the problem occurs in a very specific context and can be solved in a specific way (for example, by using a bully algorithm for a distributed election as described in Elections in a Distributed Computing System by H. Garcia-Molina, IEEE Trans. on Computers, (C-31,1), Jan. 1982).

Once the active synchronization master control 13 has been selected, the standby resorts to a monitoring mode in which it periodically polls the active instance until a failure is detected.

Since a standby is used, following a failure of the synchronization master control 13, its previous state must be reconstructed on the standby, preferably without involving the application program. This can be achieved through the information kept by the synchronization agents 14. As a consequence, except for slightly extended service times due to the recovering process, application programs are unaware of synchronization master control 13 failure.

SYNC MASTER TASK

The Sync Master Task 20 is the root task (i.e. program) of the synchronization service 10 control hierarchy. It provides the central control point for all synchronization groups. It consists of four main subcomponents as depicted in Figure 3b and is located within synchronization master control 13. The four main subcomponents of the Sync Master Task 20 are as follows:

SYNC MASTER CONTROL 21 establishes and maintains the operational state of the Sync Master Task 20. This includes the Sync Master recovery algorithm. Sync Master Control 21 consists of the main procedure of the Sync Master Task 20.

POLLING CONTROL 22 is responsible for detecting failure of processing elements 12. This subcomponent sends periodic messages to all synchronization agents 14. If a reply is not received within a certain time interval (after several retries have been attempted) the corresponding processing element 12 is declared as failed and a notification is sent to all remaining synchronization agents 14. This subcomponent is implemented within the Sync Master Task 20.

SYNC AGENT CONTROL 23 deals with events which occur at the processing element 12 level. This subcomponent is responsible for activating newly-recovered synchronization agents 14 as well as for accepting notifications, from the synchronization agents 14, about the arrivals and departures of group members 18. These are then relayed to the appropriate Group Control 24. This subcomponent is also implemented within the Sync Master Task 20.

GROUP CONTROL 24 handles events which are relevant to one group. This includes the joining and departure of group members 18. The Group Control function is implemented by the Group Master Task 25. There is one such task 25 for each synchronization group. Tasks 25 are created dynamically by the Sync Master Task 20.

The tasks comprising the Sync Master Task 20 maintain a shared detabase 16 (Figure 1) which represents a snapshot of the current state of the synchronization service 10. This database is described later.

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SYNCHRONIZATION AGENT

A synchronization agent 14 resides in the control program of each processing element 12 which requires synchronization service 10 and it is the sole representative of the Sync Master Task 20 in that processing element 12. The synchronization agent 14 has the following responsibilities:
-It accepts SYNCHRONIZE directives and creates corresponding member agents 11.
-It monitors the status of all active member agents 11 on its processing element 12 and detects their disappearance (spontaneous or planned).
-It notifies the synchronization master control 13 of all changes (arrivals and departures) of Member Agents 11 on its processing element 12.
The synchronization agent 14 is implemented by the Sync Agent Task which is part of the operating system 15 on the corresponding processing element 12.

The synchronization agents 14 are permanent representatives of synchronization master control 13 within their host processing element 12. They have three main purposes:

(1) Synchronization agents 14 are a focal point for controlling all member agents 11 within a single processing element 12. This reduces the load on synchronization master control 13 which simply sends common control information to synchronization agents 14 for distribution to local member agents 11.

(2) Synchronization agents 14 isolate member agents 11 from the effects of synchronization master control 13 failures. All communication between the synchronization master control 13 and Member Agents 11 is channeled through the synchronization agents 14. If the synchronization master control 13 is temporarily unavailable (due to failure), the synchronization agents 14 will hold member agent 11 messages destined for the synchronization master control 13 until the latter is reinstated. In this way failures of the synchronization master control 13 are masked from member agents 11 and hence the applications.

(3) Synchronization agents 14 participate in the recovery of the synchronization master control 13. When a synchronization master control 13 is being reinstated it can reconstruct its operational state simply by querying all the synchronization agents 14. This is much faster and more reliable than querying the member agents 11 since these are more dynamic and more numerous.

The synchronization master control 13 maintains a database 16 (Figure 1) which represents the current state of the synchronization service 10 within the system 15. The database can be accessed through two keys:
-by group identifier --for access to the data for a particular synchronization group, and
-by processing element identifier --for access to synchronization service components located on a particular processing element 12.

The basic structure used is the linked list of dynamically allocated control blocks, each block corresopnding to some synchronization service component. This represents a trade-off between the requirement to minimize storage costs and the need for fast access to the data.

The next section describes the operation of the internal mechanisms used to achieve the synchronization functions. In the following discussion the communication between member agents 11 is assumed to be reliable; i.e., it is non-lossy, non duplicating, and order preserving. If the communication medium is unreliable an underlying reliable communication service provided within the distributed operating system can be used.

Rights are a set of shared objects within each synchronization group; each right can be free or assicated with at most one member 18. One example of a right is a database lock whereby only one user at a time can write to a database and no one else can read or write at that time. See also the "Update" right referred to later.

Rights are distributed in a centralized fashion since that minimizes overhead and complexity. In principle, this can be done by any member agent 11. For convenience, the control and distribution of rights are performed by the distinguished member (one of the members 18). The distinguished member 18 already has the uniqueness and fault-tolerant properties which are also required by the controller for rights. Thus, the Member 18 selected as the distinguished member has to perform this special function in addition to its standard synchronization functions. The selection of a distinguished member is done, by the synchronization master control 13, at the time the group is established (see below).

When a member 18 requires a right, its member agent 11 directs the request to the distinguished member 18. If the right is available, the distinguished member 18 will grant the right and inform the requesting member agent 11. If the right is already appropriated, then depending on the type of request made, the request is either queued by the distinguished member 18 or it is refused. In the first case, requests are handled on a first-come first-served basis.

Should the current distinguished member 18 fail, a new one is appointed by the synchronization master control 13 (which is also resonsible for detecting the failure). Of course, until a new distinguished member 18 is appointed, rights cannot be distributed or retrieved, but all the other synchronization services are still available. In order to mini-

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mize the effect of a distinguished member 18 failure, the state of rights is reconstructed to the point just prior to failure. Each member 18 keeps a list of all rights which it has appropriated as well as a list of all its outstanding rights requests. This information is then exchanged with the new distinguished member 18 which can then assume the same state as the previous distinguished member 18. The entire switchover process is transparent to the application program.

If a member 18 fails, the distinguished member will automatically release any rights held by that member 18 and also purge any queued requests generated by that member 18.

Member agent 11 is the main functional component of synchronization service 10 and is responsible for handling all directives initiated by the user. It performs four classes of functions as depicted in Figure 3c and as represented by the following:

The COMMUNICATIONS HANDLER 33 provides a reliable (order-preserving, non-lossy, non-duplucating) communications service between group members 18; in order to minimize deadlocks the communication mode used is asynchronous message passing. This function is required only if there is no reliable communications service present within the distributed operating system 15.

The GROUP STATE HANDLER 32 maintains a local version of the current state of all the other group members 18.

The DIRECTIVE HANDLER 31 provides the interface between user tasks (components of members 18) and the member agent 11.

The DM HANDLER 30 implements the distinguished member functionality and is active on only one member 18 of the group at a time. This member 18 is selected by the Group Master Task 25 (Figure 3b). The distinguished member 18 is responsible for allocation of rights as well as for broadcasting group status change notifications to all other members 18 of the group. (This information is received from the Group Master Task 25.)

Member agents 11 are created dynamically by the synchronization agent 14 in response to a SYNCHRONIZE directive (Primitive). They are also destroyed by the synchronization agent 14 after they have left the group or following a failure.

Broadcasts and Acknowledgements

When an application program initiates a broadcast (via the GROUP-BROADCAST primitive), its local member agent 11 distributes the information to all other active member agents 11. It then accumulates acknowledgements until all active member agents 11 have replied after which the application program is notified (via the GRP-ACK reply signal).

If an element 12 fails before its acknowledgement is dispatched, the broadcasting member agent 11 will assume an implicit acknowledgement from that member so that failures will not disrupt the application.

Group Establishment and Joining of New Members

A newly joining member 18 first informs the synchronization master control 13 (via its synchronization agent 14) of its intent to join the synchronization group. The synchronization master control 13 then determines if this is the first reported member of the group. If it is, then this Member 18 is designated as the distinguished member 18 and a notification is sent back. This establishes the group.

If the group is already established, synchronization master control 13 registers the new member 18 as being in the joining state and informs the group's distinguished member agent 11. Upon receiving this notification the distinguished member agent 11 broadcasts a join request to all member agents 11 on the list and waits for the corresponding group acknowledgement. The period between the broadcast of the join request and the full acknowledgement of that request by all joined member agents 11 is called the joining interval. During that time some member agents 11 will become aware of the new member agent 11 before others. This opens up the possibility that some messages broadcast within the group may bypass the partially synchronized member agent 11. If messages received by this member agent 11 are passed to the application program, then the application program function of this member 18 would not necessarily perceive the same sequence of group events as other members 18; it could miss some. Therefore, the new member agent 11 must acknowledge any messages received from other member agents 11 (in order to satisfy the acknowledgement requirement) but, once acknowledged, the messages are discarded; i.e. they are not passed on to the application (an exception is messages containing other joining or departure requests which are processed by the member agent 11 but still not relayed to the application). This mode of operation remains in effect until the join

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request is finally acknowledged by the entire group. At that point, the new member 18 informs its application that it is fully joined and switches to normal operation. The overall effect, as perceived by the application, is that the joining operation is atomic.

The handling of messages that were discarded during the joining interval is no different to the application program than the handling of messages missed by the member 18 while it was down; that is, once synchronized with the gruop, the application program must proceed to upgrade its functional state to be consistent with the functional states of other members 18. The best method for achieving this depends on the application program.

Departure of Members

The departure of a member 18 from a synchronization group occurs when the member 18 decides to unsynchronize or when the host processing element 12 fails. In the former case, the departing procedure is as follows: the synchronization group (i.e. agent 11) notifies the Sync Master Task 20 of its intention. This event is relayed, via the appropriate Group Master Task 25 (Figure 3b), to the distinguished member 18 of the group. The distinguished member 18 then broadcasts this information to all other group members 18. Note that there is one Group Master Task 25 for every synchronization group defined in service 10.

In the case of a processing element 12 failure, the failure is detected by the Polling Control 22 within Sync Master Task 20 (Figure 3b) and the same sequence as described above is executed.

If the departed member 18 was a distinguished member, Group Master Task 25 will first select a new distinguished member 18 and then proceed in the same manner as above.

The synchronization agents 14 are intermediaries between synchronization master control 13 and the member agents 11. Synchronization agents 14 are created and dispatched when their host processing element 12 is initialized. Upon creation they wait to be contacted by the synchronization master 13, if one exists. Any application level requests for synchronization are queued until an acknowledgement is received from synchronization master control 13.

During normal operation, the synchronization agents 14 serve as a relay point for communication between the synchronization master control 13 and the member agents 11. All communication is buffered until acknowledged by the receiver so that the Member Agents 11 are protected from temporary failures of synchronization master control 13. The synchronization agents 14 also extract and store any information relevant to the reestablishment of the synchronization master control 13.

Most of the operation of the synchronization master control 13 has already been described above. The only aspect remaining is the monitoring function.

The monitoring of the existence of processing elements 12 is done by the Polling Control 22 which polls each individual synchronization agent 14. The failure of a processing element 12 implies that the corresponding synchronization agent 14 is down as well as all member agents 11 that were present on that processing element 12. When that happens the synchronization master control 13 notifies all affected Group Master Tasks 25. These, in turn, inform their distinguished member agents 11 which then broadcast this information to other member agents 11.

Before we go any further, it may be advantageous to introduce the primitives used with synchronization service 10. The primitives can be split into two categories:

(1) Synchronous Primitives are in the form of request-reply pairs; member agents 11 submit requests for some action to be performed on their behalf and synchronization service 10 eventually matches these with appropriate replies.

(2) Asynchronous Notifications are spontaneous signals informing a member agent 11 about changes in the status of its group or conveying a message sent by some other member agent 11.

There are only two types of asynchronous notifications that can be sent to a member agent 11:
-GROUP-CHANGE (group status) is sent when a new member 18 has joined or an active member 18 has departed from the group. The status information includes the complete new membership list and the id of the new distinguished member.
-GROUP-MSG (message) signals the arrival of a message from some other member 18 (broadcast or point-to-point).

The application program must allow forms of communication (i.e. synchronous and asynchronous) although it may choose to handle asynchronous communications in a synchronous manner by ignoring them until the current activity sequence is complete.

The synchronous primitives and corresponding replies are depicted in chart form in Figure 3a, to which attention is directed.

The primitives are:

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-SYNCHRONIZE (group-id)

This is directive which is issued by a member 18 (via its member agent 11) when it wishes to become synchronized with the group specified by <group-id>. If no group exists at the time, one is established. The only signal expected in reply to this directive is the SYNCH-DONE signal.

-SYNC-DONE (group-status)

This is a signal from the synchronization service 10 (i.e. member agent 11) in response to a successful synchronization of a member 18 following the invocation of the SYNCHRONIZE directive. The return parameter, <group status>, contains the same information about the status of the group as the GROUP-CHANGE primitive described below. It includes a <dm-flag> parameter which informs the member 18 if it is the bearer of the distinguished member status.

- UNSYNC

This directive is used when a member 18 decides to depart from its group. It ensures orderly deactivation.

-UNSYNC-DONE

This signal is a confirmation that the member 18 has been removed from its synchronization group.

-GROUP-CHANGE (group-status)

This is an asynchronous signal which is generated by the member agent 11 whenever a new member 18 joins the group or when a member 18 departs from the group. If this mmeber 18 is the new distinguished member as a result of the change, a <dm-flag> parameter in the <group-status> data record will be set appropriately. The treatment of this situation is left to the application program. The new status of the group is also returned.

-REQ-RIGHT (right-id, mode)

This directive is issued when a member 18 needs exclusive access to a group right. If the right is available, it is guaranteed to be granted to only one requesting member 18 (there may be multiple simultaneous requests for the same right). If the right is not available, then if the <mode> parameter specifie a "queued" request, it is queued until it can be serviced. Alternatively, if the <mode> parameter specifies "immediate" the request is refused since the right has already been appropriated by another member 18 of the group.

- R-GRANTED (right-id)

This signal informs a member 18 that it has been granted the required right.

-R-REFUSED (right-id)

This signal informs a member 18 which has requested a right, with the "immediate reply" mode specified in the request, that the right is not available. (If a queued request was made then this signal will never be generated.)

-REL-RIGHT (right-id)

This directive is used to release an appropriated right.

-R-RELEASED (right-id)

This signal is the reply to the REL-RIGHT directive.

-QRY-RIGHTS

This is a directive which is used to obtain a snapshot of the distribution of group rights among group members.

-R-STATUS (rights-status)

This is a reply signal to the QRY-RIGHTS directive. The <rights-status> parameter lists, for each group right, the member-id of the member which owns it, it any.

Note that service 10 cannot guarantee the currency of the returned information since changes in the distribution of rights can occur at any time.

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-GRP-BRDCST (message)

This directive is used to broadcast a synchronization event (message) to all synchronized members 18. It is the responsibility of the synchronization service 10 (via member agent 11) to ensure that all members 18 receive the message. The <message> parameter can be used to timestamp the synchronization event. The higher level software is responsible for supplying this parameter as well as interpreting its functional significance.

-GROUP-ACK

This is an acknowledgement signal for the GRP-BRDCST directive. It signifies that all members 11 have received the latest broadcast message.

-SND-TO-MEM (message)

This directive is used to send a point-to-point message to another group member 18.

-MSG-ACK

This is an acknowledgement that the latest point-to-point message has been received by the destination member 18.

Before the invention is described further, it may be of value to give some brief examples of the application of the primitives.

The first example is the control of a standby configuration. In this configuration there are two or more distributed program components (i.e. members 18) each on a different processing element 12, each of which is equally capable of providing the necessary function. Only one should be active at any given time while the others are standing by, ready to be activated should the active one fail. Assuming that they are all part of the same synchronization group that the algorithm which each member 18 executes is the same (the synchronization service primitives are highlighted in capitals):

SYNCHRONIZE;
Wait for SYNC-DONE signal;
If not selected as the distinguished member then
Repeat
Listen for SYNC-CHANGE signals;
until selected as the distinguished member;
Execute funciton;

If a member 18 is not selected as the distinguished member following synchronization with the group, then it simply waits until it is designated as the distinguished member.

The next exampled concerns the updating of a replicated database, i.e. the same example mentioned in the Background of the Invention. In this case there are multiple instances of a database, each of which can initiate an update request as a result of external activity. Such requests will be called external to distinguish them from "shadow requests". Shadow request are copies of an external request which a member 18 sends to all other members 18 so that they can make the appropriate changes to their copies of the database. For brevity, the handling of any other requests except update requests is ignored.

The solution shown below uses the mutual exclusion feature of the synchronization group. A right, called the Update right, is defined. The holder of this right is the member 18 whose request will be honored; all other members 18 must withhold their requests and perform the shadow request sent by the holder of the right:

Solution A

Repeat
Wait for next request;
If external request then
begin
REQ-RIGHT (update);
While waiting for R-GRANTED
Handle any incoming shadow requests;
GRP-BRDCST (external request);
Handle external request;
REL-RIGHT (Update);
end
else
Handle shadow request;
until termination;

Note that the application program need not be concerned with spontaneous failures of other members 18 since that is handled by the synchronization service 10.

An important problem which must be handled by this application (i.e. Solution A, above) is the addition of new or recovering instances. These will not necessarily have the same state as the others and therefore must be brought to the same functional level. The situation is complicated by the possibility that updates may be initiated at other instances whil the new instance is being upgraded. One method of dealing with this is for the new instance to appropriate the Update right to ensure that the state remains unchanged while it is being upgraded. The algorithm performed by a restarting instance is then:

SYNCHRONIZE;
Wait for SYNC-DONE signal;
REQ-RIGHT (Update);

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While waiting for R-GRANTED
Discard any shadow requests received;
Obtain current copy of database;
REL-RIGHT (Update);

Following this, the normal request-processing algorithm described above (i.e. Solution A) is executed.

The current copy of the database is obtained from any other member 18 through an internal protocol using point-to-point messages (i.e. SND-TO-MEM directives). Instead of a copy of the entire database it may be more convenient to request an update log and then perform the updates missed while the member 18 instance was down.

Figure 4 is a functional flow diagram representing the synchronization service 10 database 16 when accessed through the processing element 12 identifier.

The head and tail pointers (AGT-LST-HD and AGT-LST-TL) respectively, point to a linked list of synchronization agent control blocks (tAGT-CB) for those synchronization agents 14 involved.

There is one synchronization agent control block tAGT-CB for each processing element 12 which requires synchronization service 10. It contains a link (AGT-LST-LNK) to other synchronization agent control blocks tAGT-CB. This chain enables quick scanning of affected processing elements 12 when an entire block of processing elements 12 fails. Each synchronization agent control block tAGT-CB also contains a pointer (MMCB-LST-HD) to a chain of member agent control blocks (tMEM-CB) which reside on that processing element 12. Through this chain it is possible to detect quickly all synchronization groups which are affected by the failure of a processing element 12. Whereas all other chains in the synchronization service database 16 remain unchanged once they are established, this chain follows the dynamics of member 18 joinings and departures.

In order to simplify searching and list maintenance, the last Sync Agent control block tAGT-CB in the list is a dummy block.

Each member agent control block tMEM-CB corresponds to one member 18 of one synchronization group. Among other data, this control block contains a pointer (not shown in the diagram) to the corresponding synchronization agent control block tAGT-CB. This link allows quick reconfiguring of the processing element-Member Agent chain when necessary.

Figure 5 is a functional flow diagram representing the synchronization service database 16 when accessed through the unique group identifier.

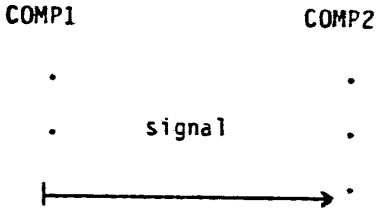
GRP-HDR [gropu id] is a static array of pointers. Each item of the array points to a circular list of member agent control blocks (tMEM-CB of which belong to the same synchronization group.

The member agent control blocks tMEM-CB are linked into a circular list to facilitate selection of a distinguished member. This list grows as members 18 are added to the synchronization group, each successive block identified by the next available positive integer (MEM-ID). This integer corresponds to the member 18 identifier.

ACTION SEQUENCES

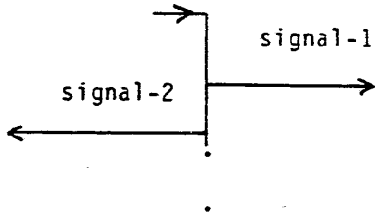
This section describes various action sequences within synchronization service 10. A diagrammatic representation is used to show these sequences. The following conventions are used.

- A full horizontal line indicates a message or rendezvous between two components (i.e. programs or tasks):



where signal is the name of the entry procedure in component COMP2 which accepts the signal. COMP1 is the component which sent the signal.

- a vertical line (1) following the reception of a signal indicates processing within the appropriate component which received the signal. This processing results in one or more signals being dispatched to other components:



- If an asterisk (*) appears next to a signal it implies that the signal may be repeated (to different destinations).
- A signal which is enclosed in braces (e.g.,<signal> indicates that the signal is not mandatory and may be omitted depending on circumstances.

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