US012389051B2

(12) **United States Patent**
Loheide et al.

(10) **Patent No.: US 12,389,051 B2**
(45) **Date of Patent: Aug. 12, 2025**

(54) **METHOD AND SYSTEM FOR MANAGING A PRE-ENCODED MEDIA ASSET FOR IMMEDIATE PLAYBACK**

(71) Applicant: **Turner Broadcasting System, Inc.**, Atlanta, GA (US)

(72) Inventors: **Donald Jude Loheide**, Mableton, GA (US); **Nishith Kumar Sinha**, Mableton, GA (US); **Nicolas Paul Webb**, McDonough, GA (US); **Pramod Reddy Patlolla**, Fremont, CA (US); **Robert Jameson**, Marietta, GA (US)

(73) Assignee: **Turner Broadcasting System, Inc.**, Atlanta, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 913 days.

(21) Appl. No.: **17/394,265**

(22) Filed: **Aug. 4, 2021**

(65) **Prior Publication Data**

US 2021/0368221 A1 Nov. 25, 2021

Related U.S. Application Data

(63) Continuation-in-part of application No. 17/094,319, filed on Nov. 10, 2020, which is a continuation of (Continued)

(51) **Int. Cl.**
H04N 21/234 (2011.01)
H04N 21/2187 (2011.01)
(Continued)

(52) **U.S. Cl.**
CPC ... ***H04N 21/23424*** (2013.01); ***H04N 21/2187*** (2013.01); ***H04N 21/2393*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H04N 21/2625; H04N 21/2187; H04N 21/26258; H04N 21/2668; H04N 21/4532; H04N 21/4583; H04N 21/8456
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,751,581 A 8/1973 Sakata et al.
4,500,930 A 2/1985 Hamalainen et al.
(Continued)

FOREIGN PATENT DOCUMENTS

AU 2015202846 A1 1/2016
KR 101061952 B1 9/2011
WO 2014/019063 A1 2/2014

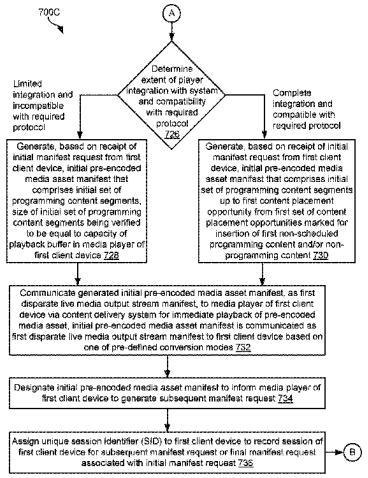
OTHER PUBLICATIONS

Corrected Notice of Allowance for U.S. Appl. No. 15/396,468 dated Oct. 17, 2022.
(Continued)

Primary Examiner — Chenea Davis
(74) *Attorney, Agent, or Firm* — Alston & Bird LLP

(57) **ABSTRACT**

A system is provided for managing a pre-encoded media asset for immediate playback. The system generates, based on a receipt of an initial manifest request from a first client device, an initial pre-encoded media asset manifest that comprises an initial set of programming content segments. The generated initial pre-encoded media asset manifest, as a first disparate live media output stream manifest, is communicated to a media player of the first client device via a content delivery system for an immediate playback of a pre-encoded media asset. The system assigns a unique SID to the first client device to record a session of the first client device for a subsequent manifest request or a final manifest request associated with the initial manifest request. A final pre-encoded media asset manifest is generated upon a
(Continued)



receipt of the subsequent manifest request from the first client device based on a defined criterion.

19 Claims, 20 Drawing Sheets

Related U.S. Application Data

application No. 16/234,870, filed on Dec. 28, 2018, now Pat. No. 10,965,967, which is a continuation-in-part of application No. 15/396,475, filed on Dec. 31, 2016.

(60) Provisional application No. 62/699,131, filed on Jul. 17, 2018.

(51) **Int. Cl.**

H04N 21/239	(2011.01)
H04N 21/2668	(2011.01)
H04N 21/45	(2011.01)
H04N 21/458	(2011.01)
H04N 21/81	(2011.01)
H04N 21/8545	(2011.01)

(52) **U.S. Cl.**

CPC ***H04N 21/2668*** (2013.01); ***H04N 21/4532*** (2013.01); ***H04N 21/4583*** (2013.01); ***H04N 21/812*** (2013.01); ***H04N 21/8153*** (2013.01); ***H04N 21/8545*** (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,294,981	A	3/1994	Yazolino et al.	
6,229,524	B1	5/2001	Chernock et al.	
6,378,129	B1	4/2002	Zetts	
6,434,621	B1	8/2002	Pezzillo et al.	
6,625,811	B1	9/2003	Kaneko	
6,701,355	B1	3/2004	Brandt et al.	
6,727,914	B1	4/2004	Gutta	
7,051,352	B1	5/2006	Schaffer	
7,337,458	B2	2/2008	Michelitsch et al.	
7,380,262	B2	5/2008	Wang et al.	
7,581,237	B1	8/2009	Kurapati	
7,610,597	B1	10/2009	Johnson et al.	
7,840,980	B2	11/2010	Gutta	
7,985,134	B2	7/2011	Ellis	
8,005,826	B1	8/2011	Sahami et al.	
8,099,757	B2	1/2012	Riedl et al.	
8,132,203	B2	3/2012	Heer	
8,234,350	B1	7/2012	Gu et al.	
8,455,803	B2	6/2013	Danzer et al.	
8,458,053	B1	6/2013	Buron et al.	
8,533,761	B1	9/2013	Sahami et al.	
8,553,853	B2	10/2013	Middleswarth et al.	
8,572,649	B1	10/2013	Gossweiler et al.	
8,578,042	B2	11/2013	Hu et al.	
8,600,382	B2	12/2013	Hicks, III	
8,631,440	B2	1/2014	Gossweiler et al.	
8,819,726	B2	8/2014	Wetzer et al.	
8,826,443	B1	9/2014	Raman et al.	
8,842,879	B2	9/2014	Laksono et al.	
8,843,965	B1	9/2014	Kurapati et al.	
8,954,521	B1	2/2015	Faaborg et al.	
9,094,639	B2	7/2015	Yim et al.	
9,130,918	B2	9/2015	Picconi et al.	
9,342,668	B2	5/2016	Wang et al.	
9,380,264	B1	6/2016	Vakalapudi	
9,390,447	B1	7/2016	Smith	
9,959,349	B1 *	5/2018	Nijim	G06F 16/78
10,045,091	B1	8/2018	Nijim et al.	
10,075,753	B2	9/2018	Loheide et al.	
10,194,177	B1	1/2019	Ashbacher	
10,586,016	B2	3/2020	Dominick et al.	
10,771,824	B1 *	9/2020	Haritaoglu	H04N 21/2387
10,856,016	B2	12/2020	Loheide et al.	
10,924,804	B2	2/2021	Loheide et al.	
10,965,967	B2	3/2021	Loheide et al.	
10,992,973	B2	4/2021	Loheide et al.	
11,051,061	B2	6/2021	Loheide et al.	
11,051,074	B2	6/2021	Loheide et al.	
11,109,086	B2	8/2021	Loheide et al.	
11,109,102	B2	8/2021	Loheide et al.	
11,134,309	B2	9/2021	Loheide et al.	
11,438,658	B2	9/2022	Loheide et al.	
11,470,373	B2	10/2022	Loheide et al.	
11,477,254	B2	10/2022	Loheide et al.	
11,483,596	B2	10/2022	Loheide et al.	
11,503,349	B2	11/2022	Loheide et al.	
11,546,400	B2	1/2023	Loheide et al.	
11,611,804	B2	3/2023	Loheide et al.	
11,622,143	B2	4/2023	Loheide et al.	
11,665,398	B2	5/2023	Loheide et al.	
11,671,641	B2	6/2023	Loheide et al.	
2002/0038457	A1	3/2002	Numata et al.	
2002/0112239	A1	8/2002	Goldman	
2002/0178447	A1	11/2002	Plotnick et al.	
2003/0023757	A1	1/2003	Ishioka et al.	
2003/0026628	A1	2/2003	Arimoto	
2003/0051239	A1	3/2003	Hudspeth	
2003/0110507	A1	6/2003	Dimitrova et al.	
2003/0126600	A1	7/2003	Heuvelman	
2003/0151538	A1	8/2003	Escobosa et al.	
2003/0182658	A1	9/2003	Alexander	
2003/0212708	A1	11/2003	Potrebic et al.	
2003/0236832	A1	12/2003	Mcintyre et al.	
2004/0022278	A1	2/2004	Thomas et al.	
2004/0031056	A1	2/2004	Wolff	
2004/0128682	A1	7/2004	Liga et al.	
2004/0163103	A1	8/2004	Swix et al.	
2004/0172650	A1	9/2004	Hawkins et al.	
2004/0172662	A1	9/2004	Danker et al.	
2005/0015816	A1	1/2005	Christofalo et al.	
2005/0060745	A1	3/2005	Riedl et al.	
2005/0096978	A1	5/2005	Black	
2005/0120369	A1	6/2005	Matz	
2005/0132401	A1	6/2005	Boccon-Gibod et al.	
2005/0135613	A1	6/2005	Brandenburg et al.	
2006/0031889	A1	2/2006	Bennett et al.	
2006/0064730	A1	3/2006	Rael et al.	
2006/0122916	A1	6/2006	Kassan	
2006/0287915	A1	12/2006	Boulet et al.	
2007/0011718	A1	1/2007	Nee	
2007/0033419	A1	2/2007	Kocher et al.	
2007/0101361	A1	5/2007	Spielman et al.	
2007/0186228	A1	8/2007	Ramaswamy et al.	
2007/0238035	A1	10/2007	Holscher et al.	
2007/0250901	A1	10/2007	McIntire et al.	
2008/0086742	A1	4/2008	Aldrey et al.	
2008/0163304	A1	7/2008	Ellis	
2008/0201735	A1	8/2008	Sumiyoshi et al.	
2008/0271078	A1	10/2008	Gossweiler et al.	
2008/0271080	A1	10/2008	Gossweiler et al.	
2008/0320513	A1	12/2008	Wong et al.	
2009/0049469	A1	2/2009	Small et al.	
2009/0070808	A1	3/2009	Jacobs	
2009/0070819	A1	3/2009	Gajda et al.	
2009/0083810	A1	3/2009	Hattori et al.	
2009/0100452	A1	4/2009	Hudgeons et al.	
2009/0187939	A1	7/2009	LaJoie	
2009/0254934	A1	10/2009	Grammens	
2009/0256972	A1	10/2009	Ramaswamy et al.	
2009/0285217	A1	11/2009	Frink et al.	
2009/0287790	A1	11/2009	Upton et al.	
2010/0010899	A1	1/2010	Lambert et al.	
2010/0125880	A1	5/2010	Roewe	
2010/0146548	A1	6/2010	Yim et al.	
2010/0146559	A1	6/2010	Lee et al.	
2010/0169914	A1	7/2010	Williamson et al.	
2010/0287297	A1	11/2010	Lefebvre	
2010/0293585	A1	11/2010	Xia	
2010/0325655	A1	12/2010	Perez	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2010/0325657 A1 12/2010 Sellers et al.
2011/0022471 A1 1/2011 Brueck et al.
2011/0052144 A1 3/2011 Abbas et al.
2011/0123062 A1 5/2011 Hilu
2011/0153464 A1 6/2011 Hendricks et al.
2011/0161500 A1 6/2011 Yengalasetti et al.
2011/0164115 A1 7/2011 Bennett et al.
2011/0177775 A1 7/2011 Gupta et al.
2011/0209181 A1 8/2011 Gupta et al.
2011/0238754 A1 9/2011 Dasilva et al.
2011/0246202 A1 10/2011 McMillan et al.
2011/0302601 A1 12/2011 Mayo et al.
2012/0017282 A1 1/2012 Kang et al.
2012/0030011 A1 2/2012 Rey et al.
2012/0110621 A1 5/2012 Gossweiler, III
2012/0143693 A1 6/2012 Chung et al.
2012/0192232 A1 7/2012 Ellis
2012/0271942 A1 10/2012 Walker et al.
2012/0272264 A1 10/2012 Suzuki et al.
2012/0272278 A1 10/2012 Bedi
2012/0284737 A1 11/2012 Savoor et al.
2012/0304223 A1 11/2012 Sargent et al.
2013/0085851 A1 4/2013 Pedro et al.
2013/0121487 A1 5/2013 Lorberbaum et al.
2013/0160051 A1 6/2013 Armstrong et al.
2013/0198328 A1 8/2013 Green et al.
2013/0205212 A1 8/2013 Sinha et al.
2013/0208811 A1 8/2013 Liu et al.
2013/0227283 A1 8/2013 Williamson et al.
2013/0227284 A1 8/2013 Pfeffer et al.
2013/0263168 A1 10/2013 Choi
2013/0263182 A1 10/2013 Ivy et al.
2013/0276023 A1 10/2013 Kent et al.
2013/0305287 A1 11/2013 Wong et al.
2013/0312041 A1 11/2013 Gabriele
2013/0325605 A1 12/2013 Callaghan et al.
2014/0013354 A1 1/2014 Johnson et al.
2014/0020017 A1 1/2014 Stern et al.
2014/0032259 A1 1/2014 Lafever et al.
2014/0033240 A1 1/2014 Card, II
2014/0071818 A1 3/2014 Wang et al.
2014/0143806 A1 5/2014 Steinberg et al.
2014/0150019 A1 5/2014 Ma et al.
2014/0152894 A1 6/2014 Childs et al.
2014/0157312 A1 6/2014 Williams et al.
2014/0173666 A1 6/2014 Gordon et al.
2014/0186001 A1 7/2014 Aldrey et al.
2014/0189514 A1 7/2014 Hilliard
2014/0189743 A1 7/2014 Kennedy et al.
2014/0189754 A1 7/2014 Major et al.
2014/0230003 A1 8/2014 Ma et al.
2014/0237243 A1 8/2014 Ma et al.
2014/0270338 A1 9/2014 Zhao et al.
2014/0282723 A1 9/2014 Sinha et al.
2014/0310745 A1 10/2014 Canney et al.
2014/0317666 A1 10/2014 Chiarulli et al.
2014/0351843 A1 11/2014 Theriault
2014/0359656 A1 12/2014 Banica et al.
2014/0366068 A1 12/2014 Burkitt et al.
2015/0012926 A1 1/2015 Wei et al.
2015/0033255 A1 1/2015 Neumann et al.
2015/0058874 A1 2/2015 Sun et al.
2015/0074732 A1 3/2015 Green et al.
2015/0106856 A1 4/2015 Rankine
2015/0127845 A1 5/2015 Phillips et al.
2015/0215359 A1 7/2015 Bao et al.
2015/0237386 A1 8/2015 Sheehan et al.
2015/0237389 A1 8/2015 Grouf et al.
2015/0249865 A1 9/2015 Oliveira
2015/0256861 A1 9/2015 Oyman
2015/0271234 A1 9/2015 O'Malley et al.
2015/0289022 A1 10/2015 Gross
2015/0381936 A1 12/2015 Goyal et al.
2015/0382042 A1 12/2015 Wagenaar et al.
2015/0382047 A1 12/2015 Van et al.
2015/0382274 A1 12/2015 Logvinov et al.
2016/0029055 A1 1/2016 Villegas et al.
2016/0063530 A1 3/2016 Lin
2016/0073155 A1 3/2016 Subramaniam et al.
2016/0077710 A1 3/2016 Lewis et al.
2016/0105477 A1 4/2016 Holden et al.
2016/0112740 A1 4/2016 Francisco et al.
2016/0127786 A1 5/2016 Langer
2016/0127788 A1 5/2016 Roberts et al.
2016/0142783 A1 5/2016 Bagga et al.
2016/0150290 A1 5/2016 Chandler et al.
2016/0165306 A1 6/2016 Nam
2016/0182923 A1* 6/2016 Higgs H04H 20/106 725/34
2016/0182954 A1 6/2016 Nguyen et al.
2016/0198202 A1 7/2016 Van et al.
2016/0227260 A1 8/2016 Hundemer et al.
2016/0255391 A1 9/2016 Noble
2016/0308958 A1 10/2016 Navali et al.
2016/0316247 A1 10/2016 Biagini et al.
2016/0337704 A1 11/2016 Binder et al.
2016/0345074 A1 11/2016 Serbest et al.
2017/0041656 A1 2/2017 Bieschke
2017/0055012 A1 2/2017 Phillips et al.
2017/0055041 A1 2/2017 Zhu
2017/0064400 A1 3/2017 Riegel et al.
2017/0070789 A1 3/2017 Liassides et al.
2017/0085935 A1 3/2017 Riedel et al.
2017/0099506 A1 4/2017 Grover
2017/0099511 A1 4/2017 Grover
2017/0099525 A1 4/2017 Ray et al.
2017/0111418 A1 4/2017 Warren et al.
2017/0118537 A1 4/2017 Stransky-Heilkron et al.
2017/0118538 A1 4/2017 Ashbacher
2017/0164019 A1 6/2017 Oh et al.
2017/0171610 A1 6/2017 Nair et al.
2017/0193544 A1 7/2017 Glasgow et al.
2017/0195718 A1 7/2017 Nair et al.
2017/0201779 A1 7/2017 Publicover et al.
2017/0238035 A1 8/2017 Perez
2017/0257446 A1 9/2017 Bevilacqua et al.
2017/0289597 A1 10/2017 Riedel et al.
2017/0308681 A1 10/2017 Gould et al.
2017/0332114 A1* 11/2017 Turgut H04N 21/2665
2018/0007060 A1 1/2018 Leblang et al.
2018/0035136 A1* 2/2018 Crowe H04N 21/47211
2018/0048599 A1 2/2018 Arghandiwal et al.
2018/0131986 A1 5/2018 Cole et al.
2018/0160159 A1 6/2018 Asarikuniyil
2018/0165650 A1 6/2018 Kashyape et al.
2018/0184047 A1 6/2018 Simonsen et al.
2018/0285747 A1 10/2018 Bron et al.
2018/0300751 A1 10/2018 Hammitt et al.
2018/0343505 A1 11/2018 Loheide et al.
2018/0367823 A1 12/2018 Brinkley et al.
2019/0068665 A1 2/2019 Kieft et al.
2019/0075148 A1* 3/2019 Nielsen H04N 21/47217
2019/0364317 A1 11/2019 Milford
2019/0380021 A1 12/2019 Meek et al.
2020/0059308 A1 2/2020 Cox et al.
2020/0244778 A1 7/2020 Berookhim et al.
2021/0297740 A1 9/2021 Loheide et al.
2022/0272411 A1 8/2022 Loheide et al.
2024/0348879 A1 10/2024 Loheide et al.

OTHER PUBLICATIONS

Corrected Notice of Allowance for U.S. Appl. No. 16/895,439 dated Sep. 14, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 16/902,893 dated Sep. 19, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,145 dated Sep. 15, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,241 dated Dec. 2, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,241 dated Oct. 20, 2022.

(56) **References Cited**

OTHER PUBLICATIONS

Corrected Notice of Allowance for U.S. Appl. No. 17/094,319 dated Sep. 23, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/147,887 dated Oct. 11, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,166 dated Sep. 23, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,677 dated Nov. 14, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,677 dated Oct. 21, 2022.
Final Office Action for U.S. Appl. No. 16/918,085 dated Oct. 24, 2022.
Final Office Action for U.S. Appl. No. 17/206,473 dated Sep. 8, 2022.
Non-Final Office Action for U.S. Appl. No. 15/988,572 dated Oct. 6, 2022.
Non-Final Office Action for U.S. Appl. No. 17/016,789 dated Sep. 22, 2022.
Non-Final Office Action for U.S. Appl. No. 17/340,538 dated Oct. 3, 2022.
Non-Final Office Action for U.S. Appl. No. 17/408,680 dated Sep. 15, 2022.
Non-Final Office Action for U.S. Appl. No. 17/453,628 dated Sep. 27, 2022.
Non-Final Office Action for U.S. Appl. No. 17/830,587 dated Nov. 25, 2022.
Notice of Allowance for U.S. Appl. No. 16/854,970 dated Oct. 13, 2022.
Notice of Allowance for U.S. Appl. No. 17/306,758 dated Sep. 16, 2022.
Notice of Allowance for U.S. Appl. No. 17/326,281 dated Dec. 7, 2022.
Notice of Allowance for U.S. Appl. No. 17/527,817 dated Oct. 3, 2022.
Notice of Allowance for U.S. Appl. No. 17/688,666 dated Sep. 20, 2022.
Notice of Allowance for U.S. Appl. No. 17/839,649 dated Oct. 19, 2022.
Notice of Allowance for U.S. Appl. No. 17/839,882 dated Oct. 26, 2022.
Notice of Allowance for U.S. Appl. No. 17/858,698 dated Oct. 4, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,256 dated Feb. 13, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,256 dated Jan. 6, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,677 dated Dec. 9, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/688,666 dated Dec. 14, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/688,666 dated Dec. 28, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/688,666 dated Feb. 10, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 17/839,882 dated Dec. 23, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/858,698 dated Dec. 28, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/858,698 dated Jan. 12, 2023.
Corrected Notice of Allowance in U.S. Appl. No. 15/396,453 dated Jun. 13, 2019.
Corrected Notice of Allowance in U.S. Appl. No. 15/396,462 dated Aug. 8, 2018.
Corrected Notice of Allowance in U.S. Appl. No. 15/396,462 dated Jul. 11, 2018.
Final Office Action for U.S. Appl. No. 15/396,468 dated Feb. 10, 2021.
Final Office Action for U.S. Appl. No. 15/396,468 dated Nov. 6, 2019.
Final Office Action for U.S. Appl. No. 15/396,475 dated Feb. 4, 2020.
Final Office Action for U.S. Appl. No. 15/396,614 dated Aug. 12, 2019.
Final Office Action for U.S. Appl. No. 15/986,218 dated Apr. 24, 2019.
Final Office Action for U.S. Appl. No. 15/986,218 dated Jan. 31, 2020.
Final Office Action for U.S. Appl. No. 15/986,286 dated Jun. 9, 2020.
Final Office Action for U.S. Appl. No. 15/986,361 dated Dec. 23, 2019.
Final Office Action for U.S. Appl. No. 15/986,406 dated May 26, 2020.
Final Office Action for U.S. Appl. No. 15/986,451 dated Dec. 16, 2019.
Final Office Action for U.S. Appl. No. 15/986,451 dated Sep. 29, 2020.
Final Office Action for U.S. Appl. No. 15/988,241 dated Jan. 8, 2020.
Final Office Action for U.S. Appl. No. 15/988,308 dated Jan. 28, 2021.
Final Office Action for U.S. Appl. No. 15/988,308 dated May 6, 2020.
Final Office Action for U.S. Appl. No. 15/988,308 dated May 9, 2019.
Final Office Action for U.S. Appl. No. 15/988,492 dated Jan. 6, 2021.
Final Office Action for U.S. Appl. No. 15/988,492 dated May 28, 2020.
Final Office Action for U.S. Appl. No. 15/988,572 dated Jul. 2, 2020.
Final Office Action for U.S. Appl. No. 16/229,310 dated Jun. 11, 2020.
Final Office Action for U.S. Appl. No. 16/229,497 dated Jun. 11, 2020.
Final Office Action for U.S. Appl. No. 16/229,614 dated Jul. 9, 2020.
Final Office Action for U.S. Appl. No. 16/230,268 dated Apr. 17, 2020.
Final Office Action for U.S. Appl. No. 16/234,870 dated Jul. 9, 2020.
Final Office Action for U.S. Appl. No. 16/235,445 dated Sep. 3, 2020.
Final Office Action for U.S. Appl. No. 16/236,713 dated Sep. 30, 2020.
Final Office Action for U.S. Appl. No. 16/854,970 dated Aug. 18, 2021.
Final Office Action for U.S. Appl. No. 15/988,572 dated May 12, 2021.
Final Office Action for U.S. Appl. No. 17/366,738 dated Jul. 20, 2023.
Final Office Action in U.S. Appl. No. 15/396,468 dated Jan. 26, 2018.
Final Office Action in U.S. Appl. No. 15/396,468 dated Nov. 15, 2018.
Final Office Action in U.S. Appl. No. 15/396,475 dated Feb. 25, 2019.
Final Office Action in U.S. Appl. No. 15/396,475 dated Jul. 12, 2018.
Final Office Action in U.S. Appl. No. 15/396,614 dated Oct. 25, 2018.
Final Office Action in U.S. Appl. No. 15/396,624 dated Jan. 24, 2019.
Non-Final Office Action dated Aug. 17, 2023, for U.S. Appl. No. 18/147,421, (7 pages), United States Patent and Trademark Office, US.
Non-Final Office Action for U.S. Appl. No. 15/396,468 dated Feb. 4, 2020.
Non-Final Office Action for U.S. Appl. No. 15/396,468 dated Jun. 1, 2021.

(56) **References Cited**

OTHER PUBLICATIONS

Corrected Notice of Allowance for U.S. Appl. No. 15/986,451 dated Jan. 5, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 15/986,451 dated Nov. 16, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,308 dated Dec. 22, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,308 dated Jan. 24, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,492 dated Dec. 3, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 17/038,323 dated Feb. 2, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/326,258 dated Dec. 22, 2021.
Final Office Action for U.S. Appl. No. 15/396,468 dated Dec. 2, 2021.
Final Office Action for U.S. Appl. No. 16/918,085 dated Dec. 8, 2021.
Non-Final Office Action for U.S. Appl. No. 17/017,052 dated Dec. 27, 2021.
Non-Final Office Action for U.S. Appl. No. 17/017,145 dated Dec. 22, 2021.
Non-Final Office Action for U.S. Appl. No. 17/017,241 dated Dec. 20, 2021.
Non-Final Office Action for U.S. Appl. No. 17/094,319 dated Dec. 8, 2021.
Non-Final Office Action for U.S. Appl. No. 17/147,887 dated Dec. 22, 2021.
Non-Final Office Acton for U.S. Appl. No. 17/016,789 dated Dec. 21, 2021.
Notice of Allowance for U.S. Appl. No. 16/985,444 dated Jan. 10, 2022.
Notice of Allowance for U.S. Appl. No. 17/016,789 dated Feb. 11, 2022.
Notice of Allowance for U.S. Appl. No. 17/017,052 dated Feb. 11, 2022.
Notice of Allowance for U.S. Appl. No. 17/017,145 dated Feb. 16, 2022.
Notice of Allowance for U.S. Appl. No. 17/038,323 dated Jan. 12, 2022.
Notice of Allowance for U.S. Appl. No. 17/094,102 dated Jan. 14, 2022.
Notice of Allowance for U.S. Appl. No. 17/326,258 dated Nov. 17, 2021.
Corrected Notice of Allowability for U.S. Appl. No. 16/230,493 dated Jul. 8, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,475 dated Aug. 24, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/986,451 dated Aug. 11, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,308 dated Oct. 20, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,492 dated Oct. 20, 2021.
Final Office Action for U.S. Appl. No. 17/038,323 dated Nov. 1, 2021.
Non-Final Office Action for U.S. Appl. No. 16/918,085 dated Aug. 19, 2021.
Non-Final Office Action for U.S. Appl. No. 15/988,572 dated Aug. 25, 2021.
Non-Final Office Action for U.S. Appl. No. 16/985,444 dated Sep. 3, 2021.
Non-Final Office Action for U.S. Appl. No. 17/094,102 dated Sep. 20, 2021.
Supplemental Notice of Allowance for U.S. Appl. No. 15/988,492 dated Nov. 9, 2021.
U.S. Appl. No. 17/094,319, filed Nov. 10, 2020, now U.S. Pat. No. 11,483,596, Issued.
U.S. Appl. No. 16/234,870, filed Dec. 28, 2018, now U.S. Pat. No. 10,965,967, Issued.
U.S. Appl. No. 15/396,475, filed Dec. 31, 2016, now U.S. Pat. No. 11,134,309, Issued.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,468 dated Apr. 1, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,308 dated Mar. 2, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 16/985,444 dated Apr. 20, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 16/985,444 dated Mar. 25, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/016,789 dated May 18, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,145 dated Mar. 4, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,145 dated May 17, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/038,323 dated Apr. 19, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,102 dated Apr. 20, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,102 dated Mar. 10, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,102 dated May 17, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,319 dated May 17, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/147,887 dated May 18, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/326,258 dated Apr. 19, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/326,258 dated Feb. 25, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/326,258 dated Mar. 14, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/326,258 dated Mar. 2, 2022.
Final Office Action for U.S. Appl. No. 15/988,572 dated Mar. 10, 2022.
Final Office Action for U.S. Appl. No. 17/017,241 dated Apr. 28, 2022.
Non-Final Office Action for U.S. Appl. No. 16/854,970 dated Feb. 17, 2022.
Non-Final Office Action for U.S. Appl. No. 16/918,085 dated Mar. 31, 2022.
Notice of Allowability for U.S. Appl. No. 16/895,439 dated May 16, 2022.
Notice of Allowability for U.S. Appl. No. 16/902,893 dated May 13, 2022.
Notice of Allowance for U.S. Appl. No. 15/396,468 dated Mar. 18, 2022.
Notice of Allowance for U.S. Appl. No. 16/895,439 dated Mar. 1, 2022.
Notice of Allowance for U.S. Appl. No. 16/902,893 dated Feb. 25, 2022.
Notice of Allowance for U.S. Appl. No. 17/094,319 dated Apr. 12, 2022.
Notice of Allowance for U.S. Appl. No. 17/147,887 dated Apr. 19, 2022.
Notice of Allowance for U.S. Appl. No. 17/326,258 dated Apr. 27, 2022.
Notice of Allowance for U.S. Appl. No. 17/340,166 dated Mar. 21, 2022.
NonFinal Office Action for U.S. Appl. No. 17/875,775, dated Dec. 7, 2023, (9 pages), United States Patent and Trademark Office, US.
Notice of Allowance for U.S. Appl. No. 15/396,475 dated Feb. 5, 2021.
Notice of Allowance for U.S. Appl. No. 15/396,624 dated May 31, 2019.
Notice of Allowance for U.S. Appl. No. 15/986,361 dated Apr. 8, 2020.

(56) **References Cited**

OTHER PUBLICATIONS

Notice of Allowance for U.S. Appl. No. 15/986,406 dated Mar. 3, 2021.
Notice of Allowance for U.S. Appl. No. 15/986,451 dated May 5, 2021.
Notice of Allowance for U.S. Appl. No. 15/988,241 dated Aug. 26, 2020.
Notice of Allowance for U.S. Appl. No. 15/988,241 dated Mar. 18, 2020.
Notice of Allowance for U.S. Appl. No. 15/988,308 dated Jul. 30, 2021.
Notice of Allowance for U.S. Appl. No. 15/988,492 dated Jul. 30, 2021.
Notice of Allowance for U.S. Appl. No. 16/128,104 dated Dec. 12, 2019.
Notice of Allowance for U.S. Appl. No. 16/229,310 dated Dec. 14, 2020.
Notice of Allowance for U.S. Appl. No. 16/229,497 dated Dec. 30, 2020.
Notice of Allowance for U.S. Appl. No. 16/229,614 dated Feb. 18, 2021.
Notice of Allowance for U.S. Appl. No. 16/230,268 dated Aug. 24, 2020.
Notice of Allowance for U.S. Appl. No. 16/230,493 dated Feb. 12, 2021.
Notice of Allowance for U.S. Appl. No. 16/231,467 dated Apr. 16, 2020.
Notice of Allowance for U.S. Appl. No. 16/234,870 dated Aug. 19, 2020.
Notice of Allowance for U.S. Appl. No. 16/235,445 dated Nov. 4, 2020.
Notice of Allowance for U.S. Appl. No. 16/236,713 dated Nov. 18, 2020.
Notice of Allowance for U.S. Appl. No. 16/299,310 dated Dec. 14, 2020.
Notice of Allowance for U.S. Appl. No. 16/902,775 dated Feb. 2, 2021.
Notice of Allowance for U.S. Appl. No. 17/408,680 dated Jul. 20, 2023.
Notice of Allowance for U.S. Appl. No. 17/408,739 dated Jul. 5, 2023.
Notice of Allowance for U.S. Appl. No. 17/742,468 dated Aug. 15, 2023.
Notice of Allowance for U.S. Appl. No. 18/149,332 dated Aug. 11, 2023.
Notice of Allowance for U.S. Appl. No. 18/157,294 dated Jul. 11, 2023.
Notice of Allowance for U.S. Appl. No. 18/161,957 dated Jul. 11, 2023.
Notice of Allowance in U.S. Appl. No. 15/396,453 dated Jan. 10, 2019.
Notice of Allowance in U.S. Appl. No. 15/396,462 dated Jun. 1, 2018.
Notice of Allowance in U.S. Appl. No. 15/396,462 dated May 15, 2018.
Notice of Allowance in U.S. Appl. No. 16/236,673 dated May 1, 2020.
Office Action in U.S. Appl. No. 15/396,453 dated Feb. 27, 2018.
Office Action in U.S. Appl. No. 15/396,475 dated Mar. 29, 2018.
Restriction Requirement for U.S. Appl. No. 16/231,467 dated Feb. 5, 2020.
Supplemental Notice of Allowance for U.S. Appl. No. 15/986,218 dated Jan. 27, 2021.
Supplemental Notice of Allowance for U.S. Appl. No. 15/986,406 dated Apr. 7, 2021.
Supplemental Notice of Allowance for U.S. Appl. No. 15/986,406 dated Jun. 9, 2021.
Supplemental Notice of Allowance for U.S. Appl. No. 17/527,817 dated Feb. 28, 2023.
Supplemental Notice of Allowance for U.S. Appl. No. 17/527,817 dated Jan. 5, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,468 dated Aug. 26, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,468 dated Jun. 24, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 16/985,444 dated Jun. 1, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/016,789 dated Jun. 27, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,052 dated Aug. 1, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,052 dated Jun. 15, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,145 dated Jul. 22, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,145 dated Jun. 2, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/017,241 dated Aug. 3, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/038,323 dated May 26, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,102 dated Aug. 3, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,102 dated Jun. 24, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,319 dated Aug. 1, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/094,319 dated Jun. 15, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/147,887 dated Jul. 22, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,166 dated Aug. 22, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,166 dated Jul. 5, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,166 dated Jun. 2, 2022.
Final Office Action for U.S. Appl. No. 16/854,970 dated Aug. 18, 2022.
Non-Final Office Action for U.S. Appl. No. 17/206,473 dated Jun. 22, 2022.
Non-Final Office Action for U.S. Appl. No. 17/326,281 dated Aug. 18, 2022.
Non-Final Office Action for U.S. Appl. No. 17/206,737 dated Jun. 23, 2022.
Non-Final Office Action for U.S. Appl. No. 17/527,817 dated Jun. 15, 2022.
Notice of Allowability for U.S. Appl. No. 16/092,893 dated Jun. 8, 2022.
Notice of Allowability for U.S. Appl. No. 16/895,439 dated Jul. 20, 2022.
Notice of Allowability for U.S. Appl. No. 16/895,439 dated Jun. 8, 2022.
Notice of Allowability for U.S. Appl. No. 16/902,893 dated Jul. 20, 2022.
Notice of Allowance for U.S. Appl. No. 17/017,241 dated Jul. 15, 2022.
Notice of Allowance for U.S. Appl. No. 17/340,677 dated Aug. 8, 2022.
Advisory Action for U.S. Appl. No. 17/408,680 dated Mar. 28, 2023.
Advisory Action for U.S. Appl. No. 17/408,739 dated Mar. 28, 2023.
Final Office Action for U.S. Appl. No. 15/988,572 dated Apr. 11, 2023.
Non-Final Office Action for U.S. Appl. No. 17/206,737 dated Jun. 8, 2023.
Non-Final Office Action for U.S. Appl. No. 17/734,704 dated Jun. 21, 2023.
Non-Final Office Action for U.S. Appl. No. 17/739,885 dated Mar. 30, 2023.

(56) **References Cited**

OTHER PUBLICATIONS

Non-Final Office Action for U.S. Appl. No. 17/742,468 dated Mar. 30, 2023.
Non-Final Office Action for U.S. Appl. No. 18/149,332 dated Apr. 27, 2023.
Notice of Allowance for U.S. Appl. No. 17/708,241 dated Apr. 5, 2023.
Notice of Allowance for U.S. Appl. No. 17/206,473 dated Mar. 30, 2023.
Notice of Allowance for U.S. Appl. No. 17/986,403 dated Apr. 7, 2023.
Notice of Allowance for U.S. Appl. No. 18/158,202 dated May 25, 2023.
Notice of Allowance for U.S. Appl. No. 18/160,833 dated Jun. 14, 2023.
Final Office Action for U.S. Appl. No. 17/206,737 dated Jan. 5, 2023.
Final Office Action for U.S. Appl. No. 17/408,680 dated Jan. 12, 2023.
Final Office Action for U.S. Appl. No. 17/408,739 dated Jan. 12, 2023.
Non-Final Office Action for U.S. Appl. No. 17/206,473 dated Dec. 22, 2022.
Non-Final Office Action for U.S. Appl. No. 17/366,738 dated Dec. 9, 2022.
Non-Final Office Action for U.S. Appl. No. 17/708,241 dated Dec. 20, 2022.
Notice of Allowance for U.S. Appl. No. 17/731,049 dated Mar. 2, 2023.
Notice of Allowance for U.S. Appl. No. 16/918,085 dated Jan. 13, 2023.
Notice of Allowance for U.S. Appl. No. 17/340,538 dated Jan. 23, 2023.
Notice of Allowance for U.S. Appl. No. 17/453,628 dated Mar. 2, 2023.
Notice of Allowance for U.S. Appl. No. 17/830,587 dated Mar. 9, 2023.
Notice of Allowance for U.S. Appl. No. 17/830,788 dated Dec. 9, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/340,538 dated Feb. 15, 2023.
Non-Final Office Action for U.S. Appl. No. 15/396,475 dated Aug. 6, 2020.
Non-Final Office Action for U.S. Appl. No. 15/396,475 dated Aug. 8, 2019.
Non-Final Office Action for U.S. Appl. No. 15/396,624 dated Oct. 16, 2019.
Non-Final Office Action for U.S. Appl. No. 15/986,218 dated Sep. 27, 2019.
Non-Final Office Action for U.S. Appl. No. 15/986,286 dated Nov. 29, 2019.
Non-Final Office Action for U.S. Appl. No. 15/986,361 dated Jul. 11, 2019.
Non-Final Office Action for U.S. Appl. No. 15/986,406 dated Dec. 18, 2019.
Non-Final Office Action for U.S. Appl. No. 15/986,406 dated Oct. 30, 2020.
Non-Final Office Action for U.S. Appl. No. 15/986,451 dated Apr. 16, 2020.
Non-Final Office Action for U.S. Appl. No. 15/986,451 dated Jun. 27, 2019.
Non-Final Office Action for U.S. Appl. No. 15/988,241 dated Jun. 27, 2019.
Non-Final Office Action for U.S. Appl. No. 15/988,308 dated Dec. 3, 2019.
Non-Final Office Action for U.S. Appl. No. 15/988,308 dated Sep. 8, 2020.
Non-Final Office Action for U.S. Appl. No. 15/988,492 dated Apr. 14, 2021.
Non-Final Office Action for U.S. Appl. No. 15/988,492 dated Feb. 18, 2020.
Non-Final Office Action for U.S. Appl. No. 15/988,492 dated Sep. 10, 2020.
Non-Final Office Action for U.S. Appl. No. 15/988,572 dated Dec. 27, 2019.
Non-Final Office Action for U.S. Appl. No. 15/988,572 dated Nov. 6, 2020.
Non-Final Office Action for U.S. Appl. No. 16/128, 104 dated Aug. 21, 2019.
Non-Final Office Action for U.S. Appl. No. 16/229,310 dated Nov. 29, 2019.
Non-Final Office Action for U.S. Appl. No. 16/229,497 dated Dec. 12, 2019.
Non-Final Office Action for U.S. Appl. No. 16/229,614 dated Mar. 19, 2020.
Non-Final Office Action for U.S. Appl. No. 16/230,268 dated Jan. 8, 2020.
Non-Final Office Action for U.S. Appl. No. 16/234,870 dated Jan. 9, 2020.
Non-Final Office Action for U.S. Appl. No. 16/235,445 dated Apr. 2, 2020.
Non-Final Office Action for U.S. Appl. No. 16/236,673 dated Jan. 10, 2020.
Non-Final Office Action for U.S. Appl. No. 16/236,713 dated May 29, 2020.
Non-Final Office Action for U.S. Appl. No. 16/854,970 dated Mar. 17, 2021.
Non-Final Office Action for U.S. Appl. No. 16/902,775 dated Oct. 5, 2020.
Non-Final Office Action for U.S. Appl. No. 17/038,323 dated Jul. 1, 2021.
Non-Final Office Action for U.S. Appl. No. 17/970,753 dated Aug. 17, 2023.
Non-Final Office Action for U.S. Appl. No. 18/147,421 dated Aug. 17, 2023.
Non-Final Office Action for U.S. Appl. No. 18/153,636 dated Jul. 19, 2023.
Non-Final Office Action in U.S. Appl. No. 15/396,453 dated Jun. 14, 2018.
Non-Final Office Action in U.S. Appl. No. 15/396,468 dated Jul. 3, 2018.
Non-Final Office Action in U.S. Appl. No. 15/396,468 dated Mar. 1, 2019.
Non-Final Office Action in U.S. Appl. No. 15/396,475 dated Nov. 30, 2018.
Non-Final Office Action in U.S. Appl. No. 15/396,614 dated Mar. 7, 2019.
Non-Final Office Action in U.S. Appl. No. 15/396,614 dated May 18, 2018.
Non-Final Office Action in U.S. Appl. No. 15/396,624 dated Jul. 13, 2018.
Non-Final Office Action in U.S. Appl. No. 15/986,218 dated Nov. 28, 2018.
Notice of Allowability for U.S. Appl. No. 15/986,218 dated Jul. 13, 2020.
Notice of Allowability for U.S. Appl. No. 15/986,361 dated Aug. 18, 2020.
Notice of Allowability for U.S. Appl. No. 15/986,361 dated Jul. 14, 2020.
Notice of Allowability for U.S. Appl. No. 15/986,361 dated May 15, 2020.
Notice of Allowability for U.S. Appl. No. 15/986,361 dated Sep. 30, 2020.
Notice of Allowability for U.S. Appl. No. 16/918,085 dated Mar. 1, 2023.
Notice of Allowability for U.S. Appl. No. 17/839,649 dated Jan. 25, 2023.
Final Rejection Mailed on Jun. 18, 2024 for U.S. Appl. No. 17/875,775, 10 page(s).
Non-Final Rejection Mailed on Jun. 13, 2024 for U.S. Appl. No. 18/323,582, 13 page(s).

(56) **References Cited**

OTHER PUBLICATIONS

Non-Final Rejection Mailed on Jun. 18, 2024 for U.S. Appl. No. 18/508,682, 7 page(s).
Non-Final Rejection Mailed on Sep. 19, 2024 for U.S. Appl. No. 18/433,662, 16 page(s).
Non-Final Rejection Mailed on Jan. 16, 2025 for U.S. Appl. No. 18/748,775, 14 page(s).
Non-Final Rejection Mailed on Mar. 26, 2025 for U.S. Appl. No. 18/323,582, 10 page(s).
Final Rejection Mailed on Dec. 3, 2024 for U.S. Appl. No. 18/323,582, 9 page(s).
Final Rejection Mailed on Dec. 19, 2024 for U.S. Appl. No. 18/508,682, 8 page(s).
Non-Final Rejection Mailed on Dec. 3, 2024 for U.S. Appl. No. 18/635,550, 13 page(s).
Non-Final Rejection Mailed on Nov. 21, 2024 for U.S. Appl. No. 18/620,001, 12 page(s).
Advisory Action for U.S. Appl. No. 15/396,468 dated Jan. 16, 2020.
Advisory Action for U.S. Appl. No. 15/396,475 dated Jun. 3, 2019.
Advisory Action for U.S. Appl. No. 15/396,475 dated May 13, 2020.
Advisory Action for U.S. Appl. No. 15/396,614 dated Oct. 24, 2019.
Advisory Action for U.S. Appl. No. 15/986,218 dated Jul. 12, 2019.
Advisory Action for U.S. Appl. No. 15/986,361 dated Feb. 26, 2020.
Advisory Action for U.S. Appl. No. 15/986,451 dated Feb. 20, 2020.
Advisory Action for U.S. Appl. No. 15/988,308 dated Jul. 16, 2019.
Advisory Action in U.S. Appl. No. 15/396,453 dated Apr. 20, 2018.
Advisory Action in U.S. Appl. No. 15/396,468 dated Jan. 7, 2019.
Advisory Action in U.S. Appl. No. 15/396,475 dated Sep. 20, 2018.
Advisory Action in U.S. Appl. No. 15/396,614 dated Mar. 16, 2018.
Corrected Notice Allowance for U.S. Appl. No. 16/230,268 dated Oct. 9, 2020.
Corrected Notice Allowance for U.S. Appl. No. 16/231,467 dated Oct. 1, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,453 dated Jun. 3, 2019.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,475 dated Jul. 12, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,624 dated Aug. 14, 2019.
Corrected Notice of Allowance for U.S. Appl. No. 15/396,624 dated Sep. 5, 2019.
Corrected Notice of Allowance for U.S. Appl. No. 15/986,286 dated May 27, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/986,406 dated Jul. 16, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,241 dated Aug. 13, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,241 dated Jun. 22, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,241 dated May 8, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 15/988,241 dated Nov. 18, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/128,104 dated Apr. 15, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/128,104 dated Jul. 8, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/128,104 dated May 20, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/229,310 dated Apr. 27, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/229,310 dated Jun. 3, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/229,497 dated Jun. 3, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/229,614 dated Jun. 29, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/230,268 dated Dec. 2, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/231,467 dated Nov. 20, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/234,870 dated Feb. 24, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/234,870 dated Jan. 15, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/235,445 dated Mar. 26, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/236,673 dated Oct. 23, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/236,673 dated Sep. 21, 2020.
Corrected Notice of Allowance for U.S. Appl. No. 16/236,713 dated Apr. 8, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/236,713 dated May 17, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/854,970 dated Jan. 23, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 16/854,970 dated Jan. 5, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 16/902,775 dated Apr. 26, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/902,775 dated Apr. 9, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/902,775 dated Jul. 30, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 16/902,775 dated Jun. 11, 2021.
Corrected Notice of Allowance for U.S. Appl. No. 17/306,758 dated Dec. 21, 2022.
Corrected Notice of Allowance for U.S. Appl. No. 17/306,758 dated Feb. 15, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 17/306,758 dated Jan. 5, 2023.
Corrected Notice of Allowance for U.S. Appl. No. 17/326,281 dated Dec. 22, 2022.

* cited by examiner

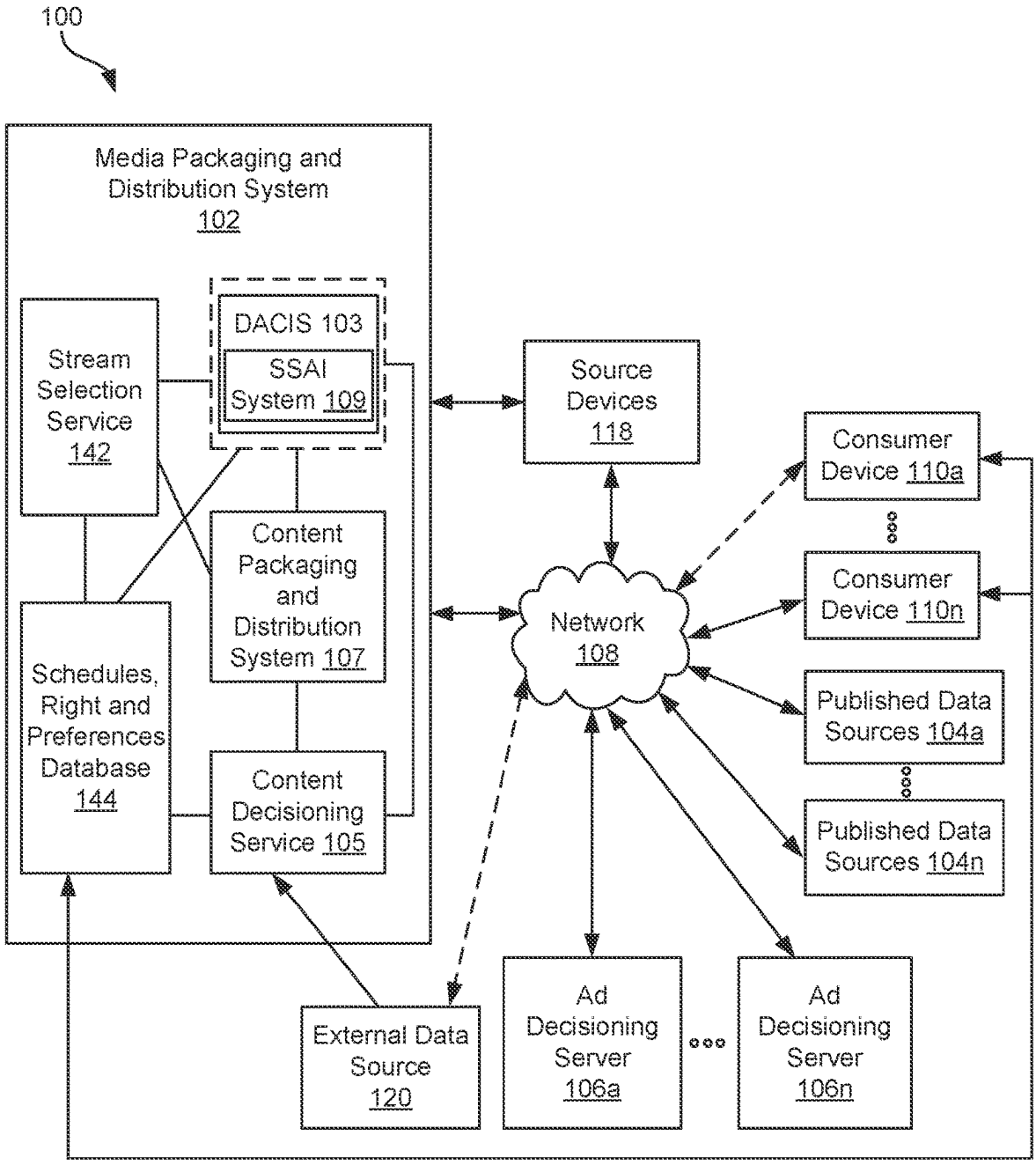

100
Media Packaging and Distribution System 102
DACIS 103
SSAI System 109
Stream Selection Service 142
Content Packaging and Distribution System 107
Schedules, Right and Preferences Database 144
Content Decisioning Service 105
Source Devices 118
Network 108
Consumer Device 110a
Consumer Device 110n
Published Data Sources 104a
Published Data Sources 104n
External Data Source 120
Ad Decisioning Server 106a
Ad Decisioning Server 106n

FIG. 1A

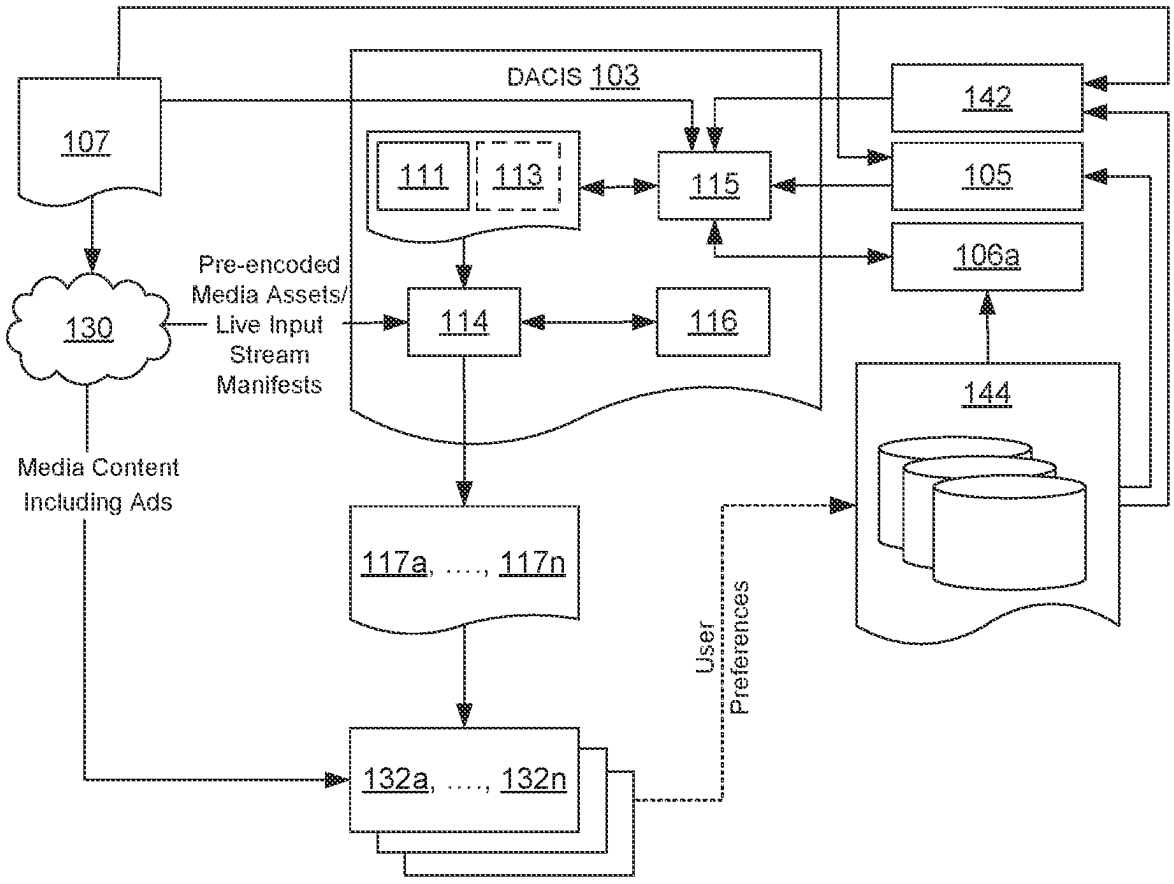

DACIS 103
107
111
113
115
142
105
106a
130
Pre-encoded
Media Assets/
Live Input
Stream
Manifests
114
116
144
Media Content
Including Ads
117a, ..., 117n
User
Preferences
132a, ..., 132n

FIG. 1B

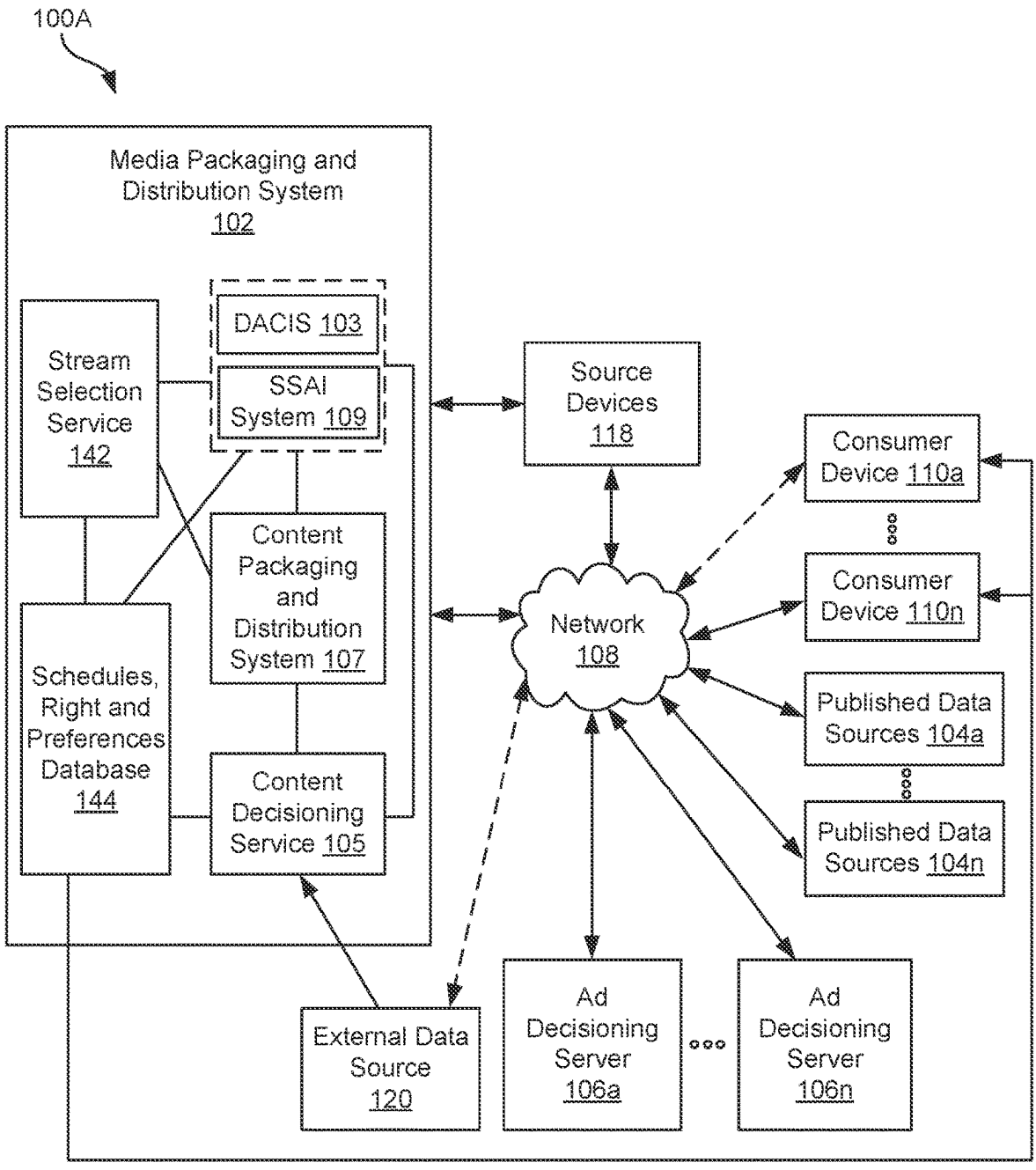

100A
Media Packaging and Distribution System 102
DACIS 103
SSAI System 109
Stream Selection Service 142
Content Packaging and Distribution System 107
Schedules, Right and Preferences Database 144
Content Decisioning Service 105
Source Devices 118
Network 108
Consumer Device 110a
Consumer Device 110n
Published Data Sources 104a
Published Data Sources 104n
External Data Source 120
Ad Decisioning Server 106a
Ad Decisioning Server 106n

FIG. 1C

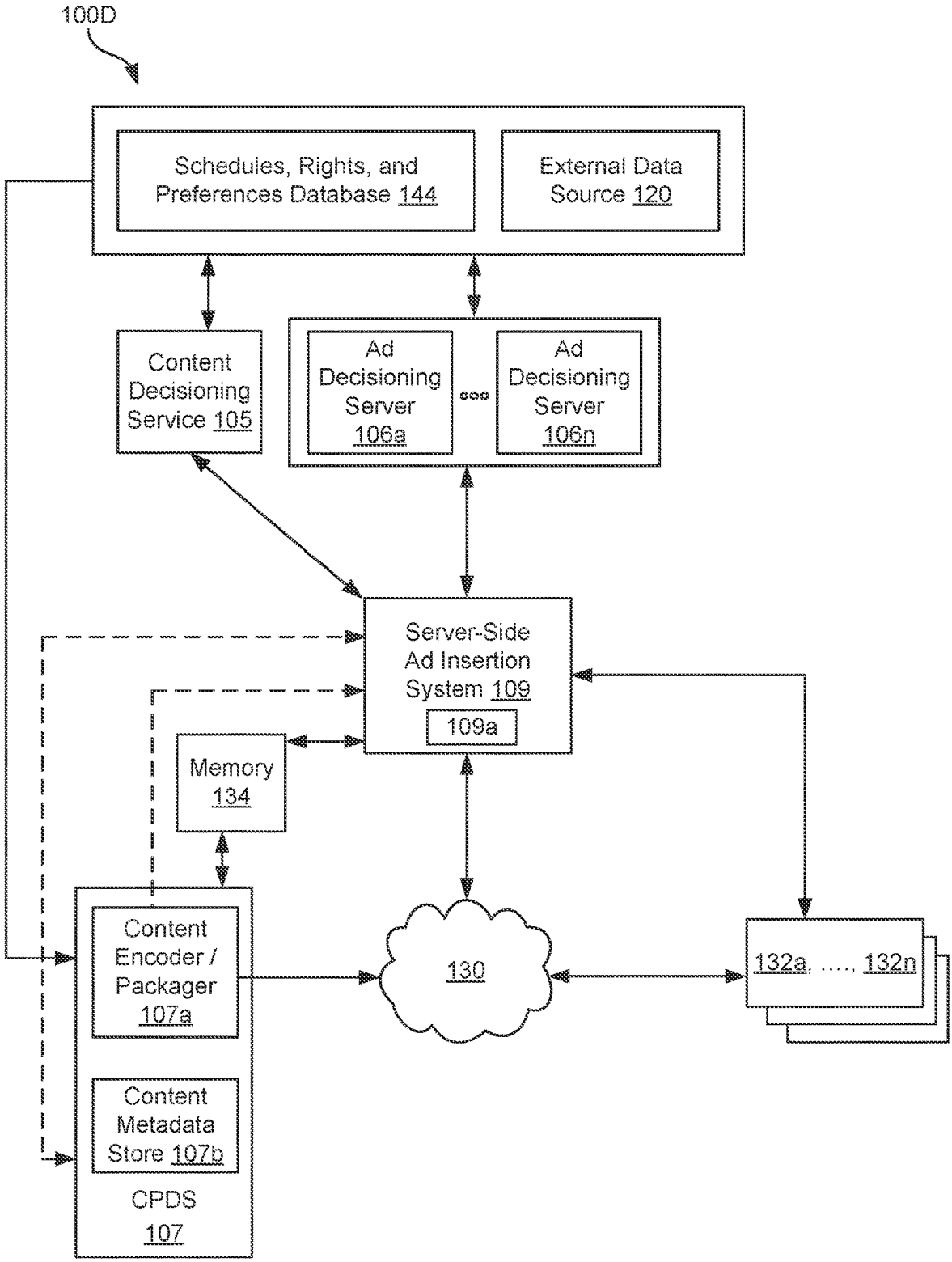

100D
Schedules, Rights, and Preferences Database 144
External Data Source 120
Content Decisioning Service 105
Ad Decisioning Server 106a
Ad Decisioning Server 106n
Server-Side Ad Insertion System 109
109a
Memory 134
Content Encoder / Packager 107a
Content Metadata Store 107b
CPDS 107
130
132a, ..., 132n

FIG. 1D

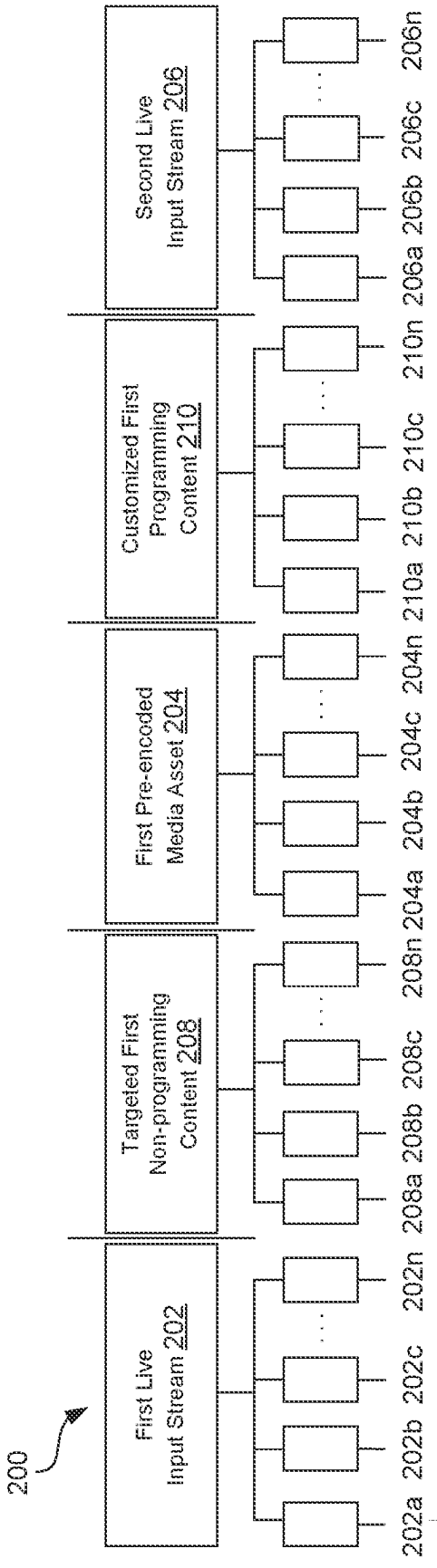

200
First Live Input Stream 202
Targeted First Non-programming Content 208
First Pre-encoded Media Asset 204
Customized First Programming Content 210
Second Live Input Stream 206
202a 202b 202c 202n
208a 208b 208c 208n
204a 204b 204c 204n
210a 210b 210c 210n
206a 206b 206c 206n
Quality Level 1
Quality Level 2
Quality Level 3
212

FIG. 2

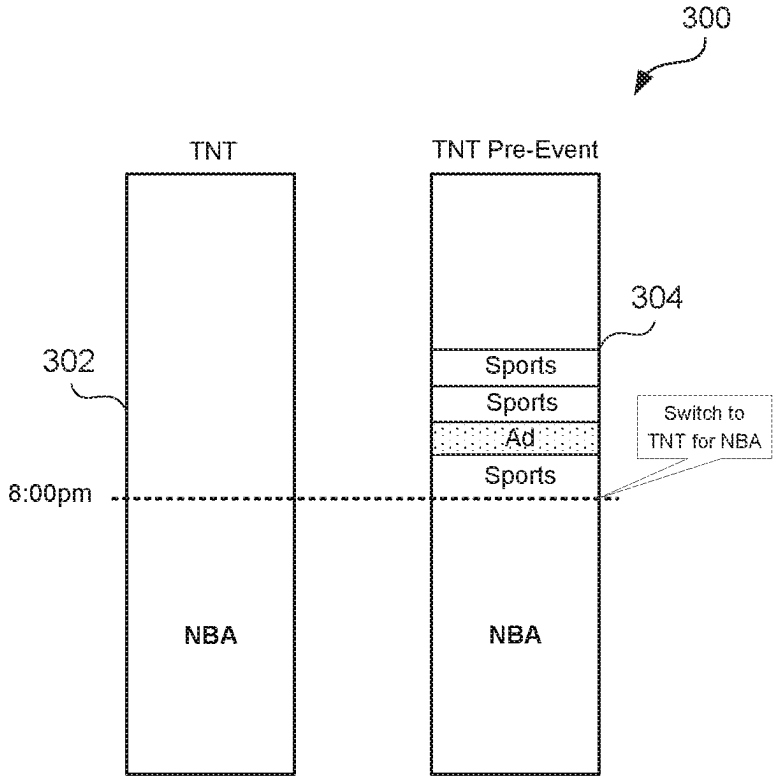

300
TNT
TNT Pre-Event
304
302
Sports
Sports
Ad
Sports
Switch to TNT for NBA
8:00pm
NBA
NBA

FIG. 3

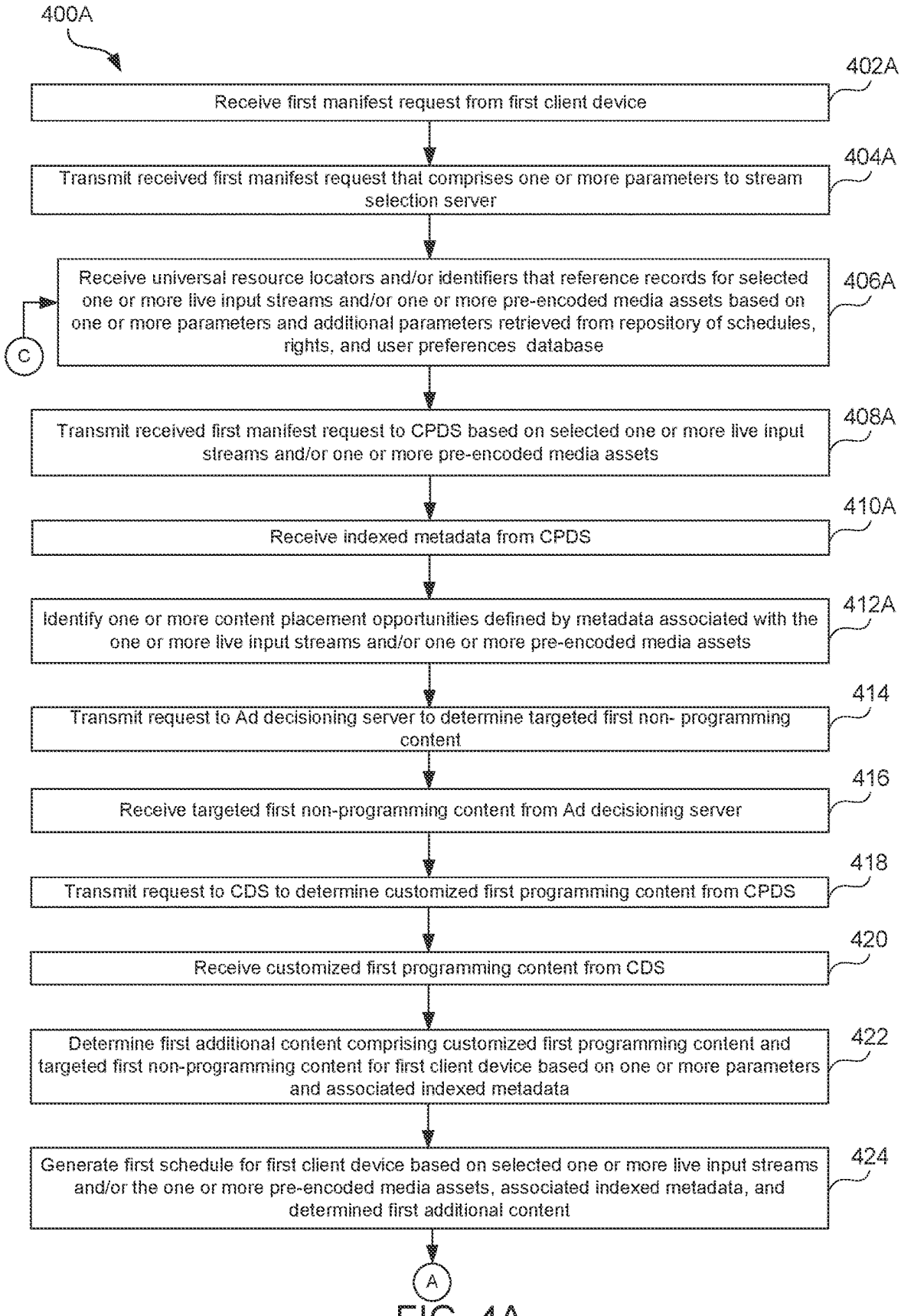

400A
402A
Receive first manifest request from first client device
404A
Transmit received first manifest request that comprises one or more parameters to stream selection server
406A
Receive universal resource locators and/or identifiers that reference records for selected one or more live input streams and/or one or more pre-encoded media assets based on one or more parameters and additional parameters retrieved from repository of schedules, rights, and user preferences database
C
408A
Transmit received first manifest request to CPDS based on selected one or more live input streams and/or one or more pre-encoded media assets
410A
Receive indexed metadata from CPDS
412A
Identify one or more content placement opportunities defined by metadata associated with the one or more live input streams and/or one or more pre-encoded media assets
414
Transmit request to Ad decisioning server to determine targeted first non- programming content
416
Receive targeted first non-programming content from Ad decisioning server
418
Transmit request to CDS to determine customized first programming content from CPDS
420
Receive customized first programming content from CDS
422
Determine first additional content comprising customized first programming content and targeted first non-programming content for first client device based on one or more parameters and associated indexed metadata
424
Generate first schedule for first client device based on selected one or more live input streams and/or the one or more pre-encoded media assets, associated indexed metadata, and determined first additional content
A

FIG. 4A

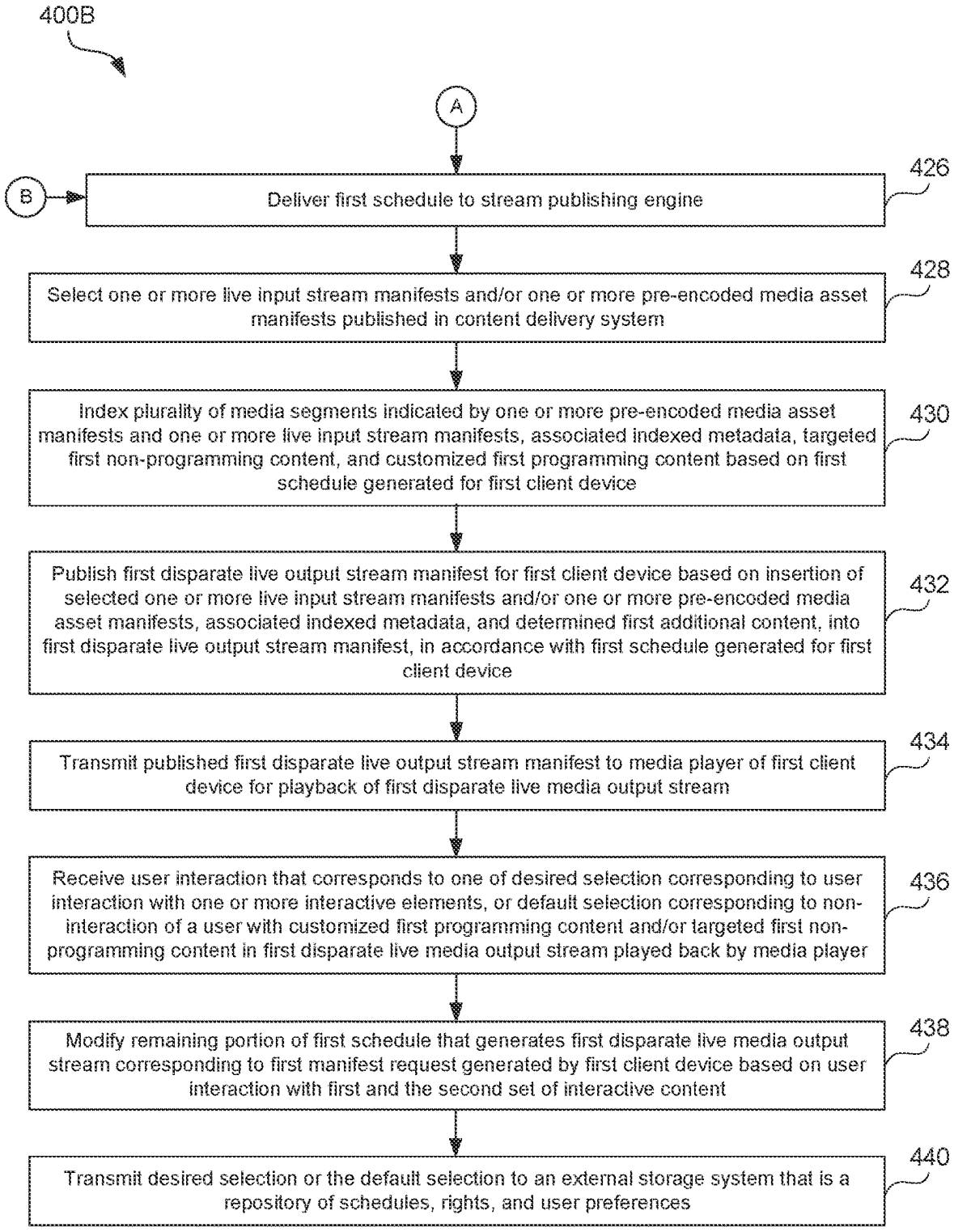

400B
A
B
Deliver first schedule to stream publishing engine
426
Select one or more live input stream manifests and/or one or more pre-encoded media asset manifests published in content delivery system
428
Index plurality of media segments indicated by one or more pre-encoded media asset manifests and one or more live input stream manifests, associated indexed metadata, targeted first non-programming content, and customized first programming content based on first schedule generated for first client device
430
Publish first disparate live output stream manifest for first client device based on insertion of selected one or more live input stream manifests and/or one or more pre-encoded media asset manifests, associated indexed metadata, and determined first additional content, into first disparate live output stream manifest, in accordance with first schedule generated for first client device
432
Transmit published first disparate live output stream manifest to media player of first client device for playback of first disparate live media output stream
434
Receive user interaction that corresponds to one of desired selection corresponding to user interaction with one or more interactive elements, or default selection corresponding to non-interaction of a user with customized first programming content and/or targeted first non-programming content in first disparate live media output stream played back by media player
436
Modify remaining portion of first schedule that generates first disparate live media output stream corresponding to first manifest request generated by first client device based on user interaction with first and the second set of interactive content
438
Transmit desired selection or the default selection to an external storage system that is a repository of schedules, rights, and user preferences
440

FIG. 4B

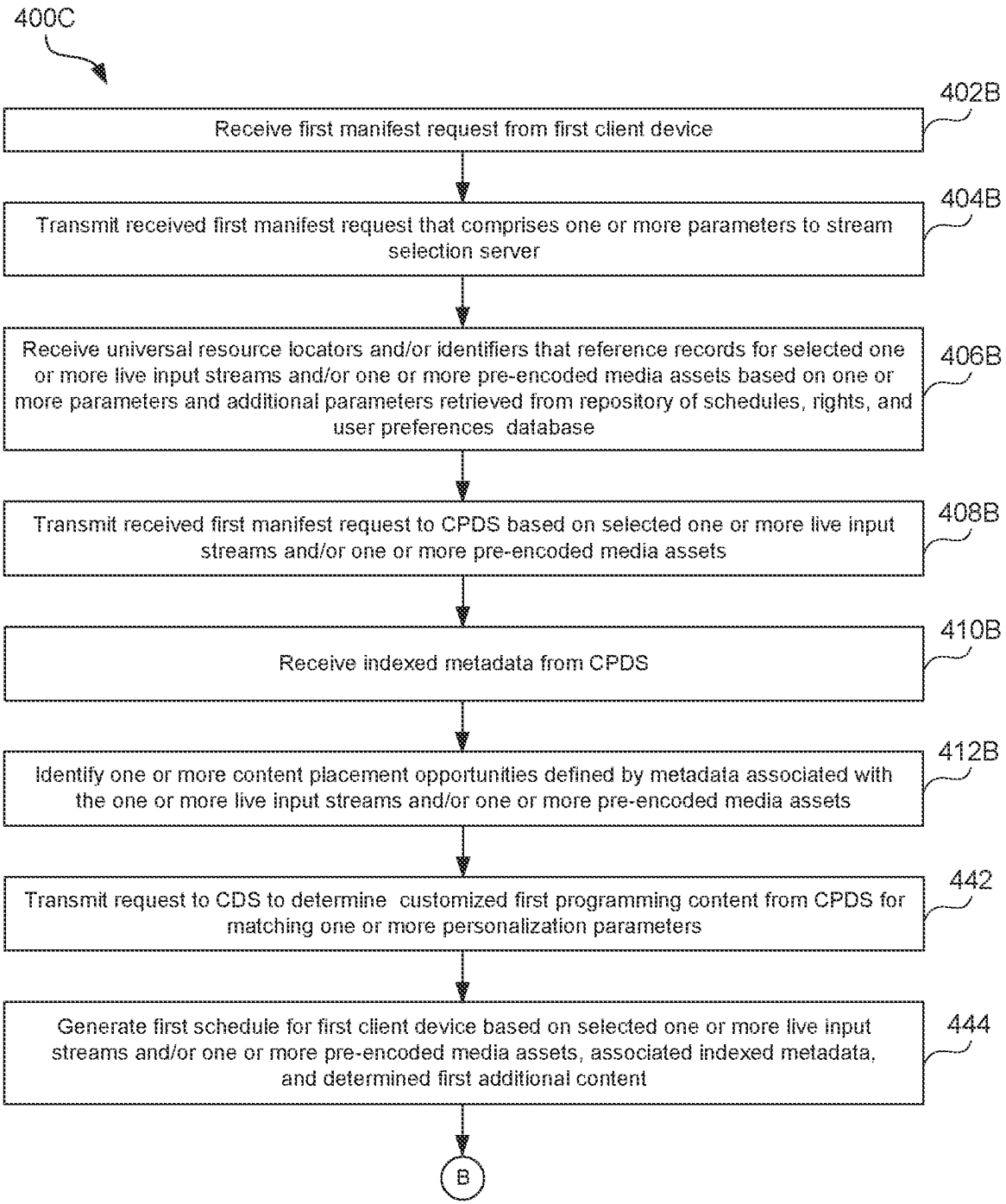

400C
Receive first manifest request from first client device
402B
Transmit received first manifest request that comprises one or more parameters to stream selection server
404B
Receive universal resource locators and/or identifiers that reference records for selected one or more live input streams and/or one or more pre-encoded media assets based on one or more parameters and additional parameters retrieved from repository of schedules, rights, and user preferences database
406B
Transmit received first manifest request to CPDS based on selected one or more live input streams and/or one or more pre-encoded media assets
408B
Receive indexed metadata from CPDS
410B
Identify one or more content placement opportunities defined by metadata associated with the one or more live input streams and/or one or more pre-encoded media assets
412B
Transmit request to CDS to determine customized first programming content from CPDS for matching one or more personalization parameters
442
Generate first schedule for first client device based on selected one or more live input streams and/or one or more pre-encoded media assets, associated indexed metadata, and determined first additional content
444
B

FIG. 4C

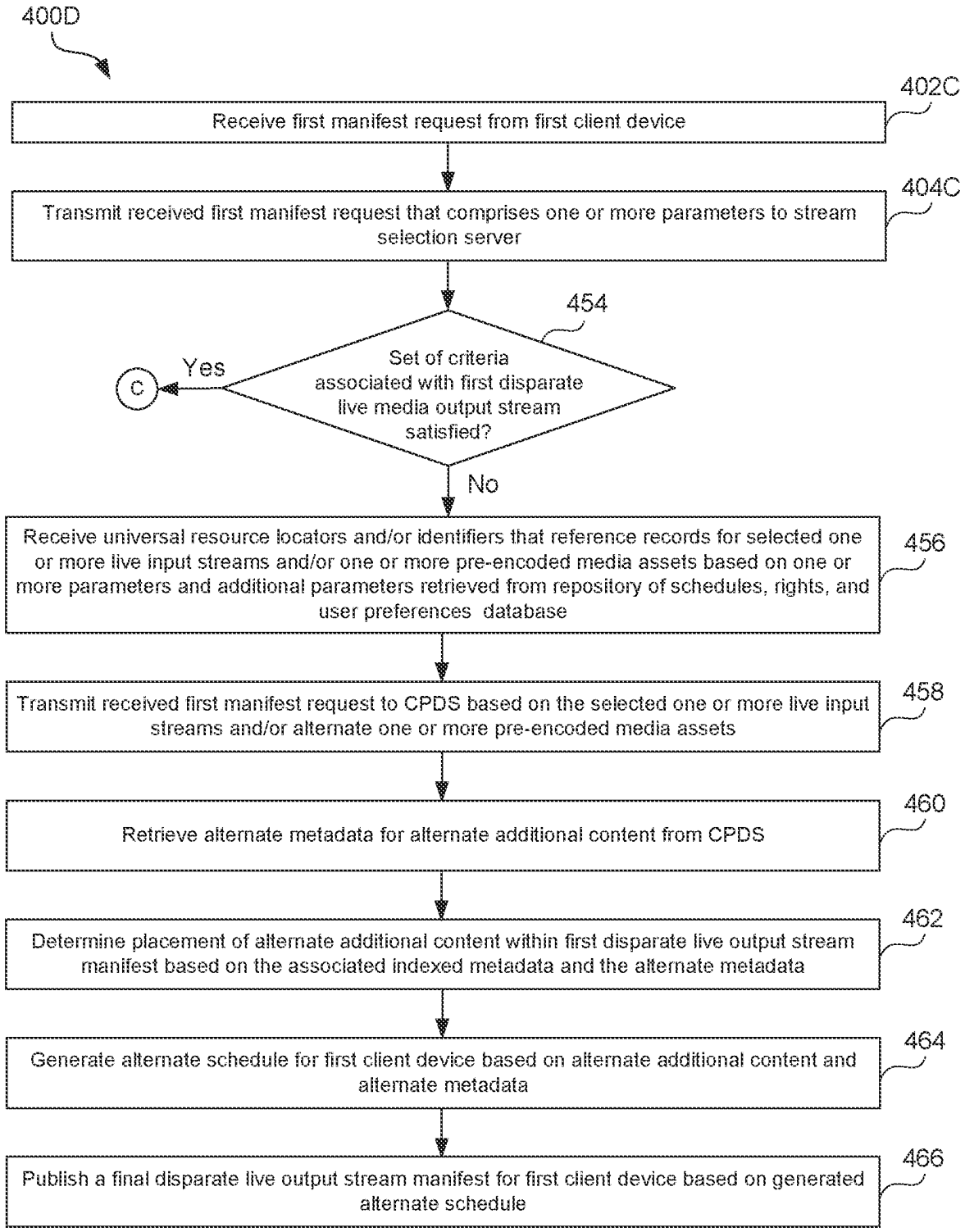

400D
402C
Receive first manifest request from first client device
404C
Transmit received first manifest request that comprises one or more parameters to stream selection server
454
Set of criteria associated with first disparate live media output stream satisfied?
Yes
C
No
456
Receive universal resource locators and/or identifiers that reference records for selected one or more live input streams and/or one or more pre-encoded media assets based on one or more parameters and additional parameters retrieved from repository of schedules, rights, and user preferences database
458
Transmit received first manifest request to CPDS based on the selected one or more live input streams and/or alternate one or more pre-encoded media assets
460
Retrieve alternate metadata for alternate additional content from CPDS
462
Determine placement of alternate additional content within first disparate live output stream manifest based on the associated indexed metadata and the alternate metadata
464
Generate alternate schedule for first client device based on alternate additional content and alternate metadata
466
Publish a final disparate live output stream manifest for first client device based on generated alternate schedule

FIG. 4D

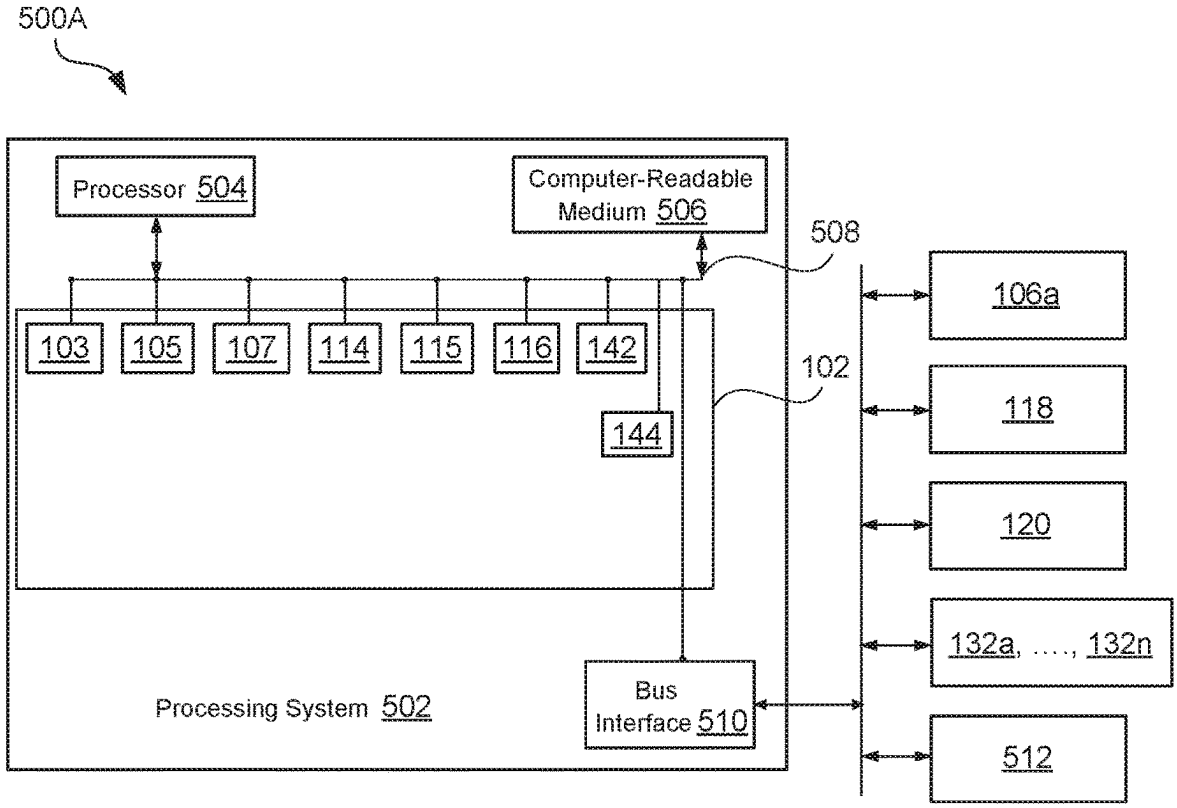

500A
Processor 504
Computer-Readable Medium 506
508
103
105
107
114
115
116
142
144
102
106a
118
120
132a, ..., 132n
512
Bus Interface 510
Processing System 502

FIG. 5A

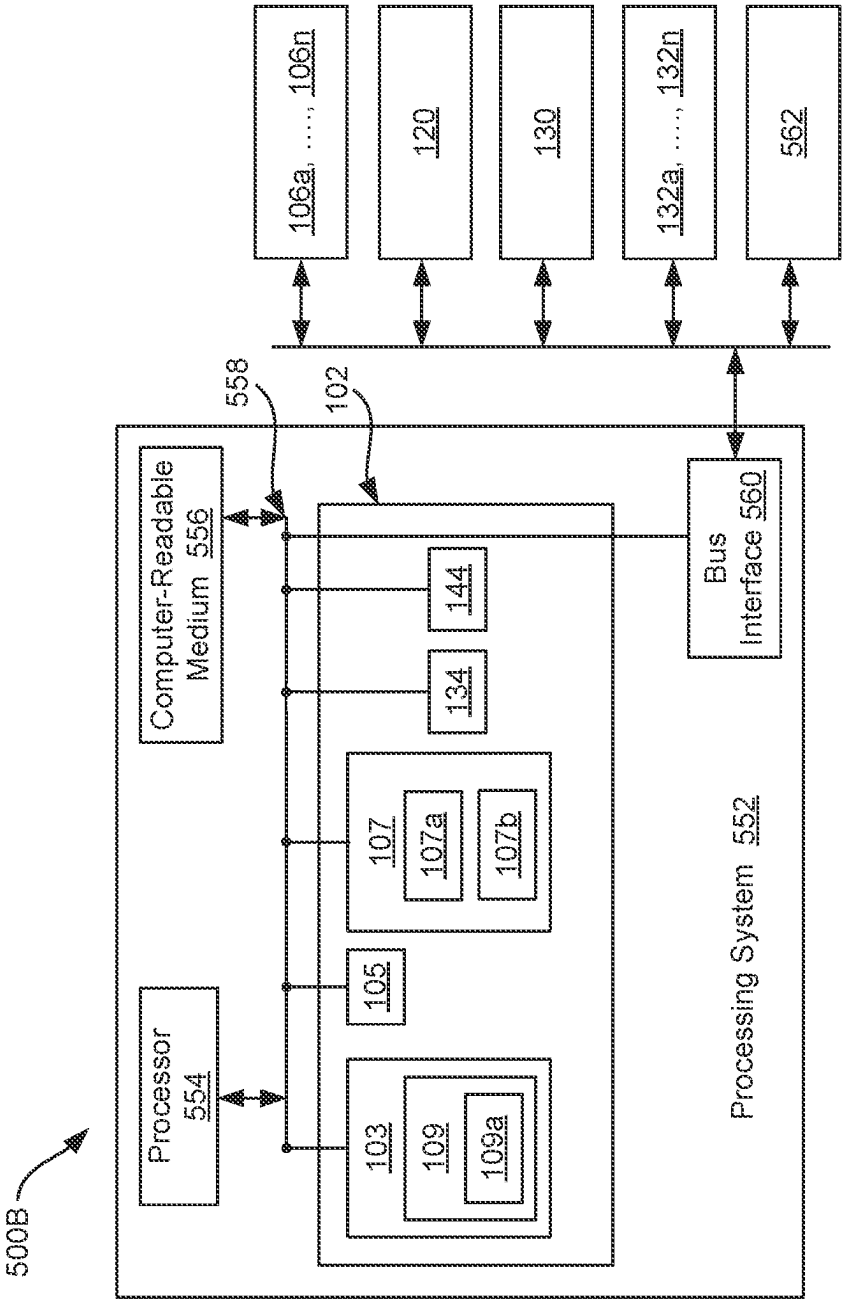

500B
Processor 554
Computer-Readable Medium 556
558
102
Bus Interface 560
Processing System 552
103
109
109a
105
107
107a
107b
134
144
106a, ..., 106n
120
130
132a, ..., 132n
562

FIG. 5B

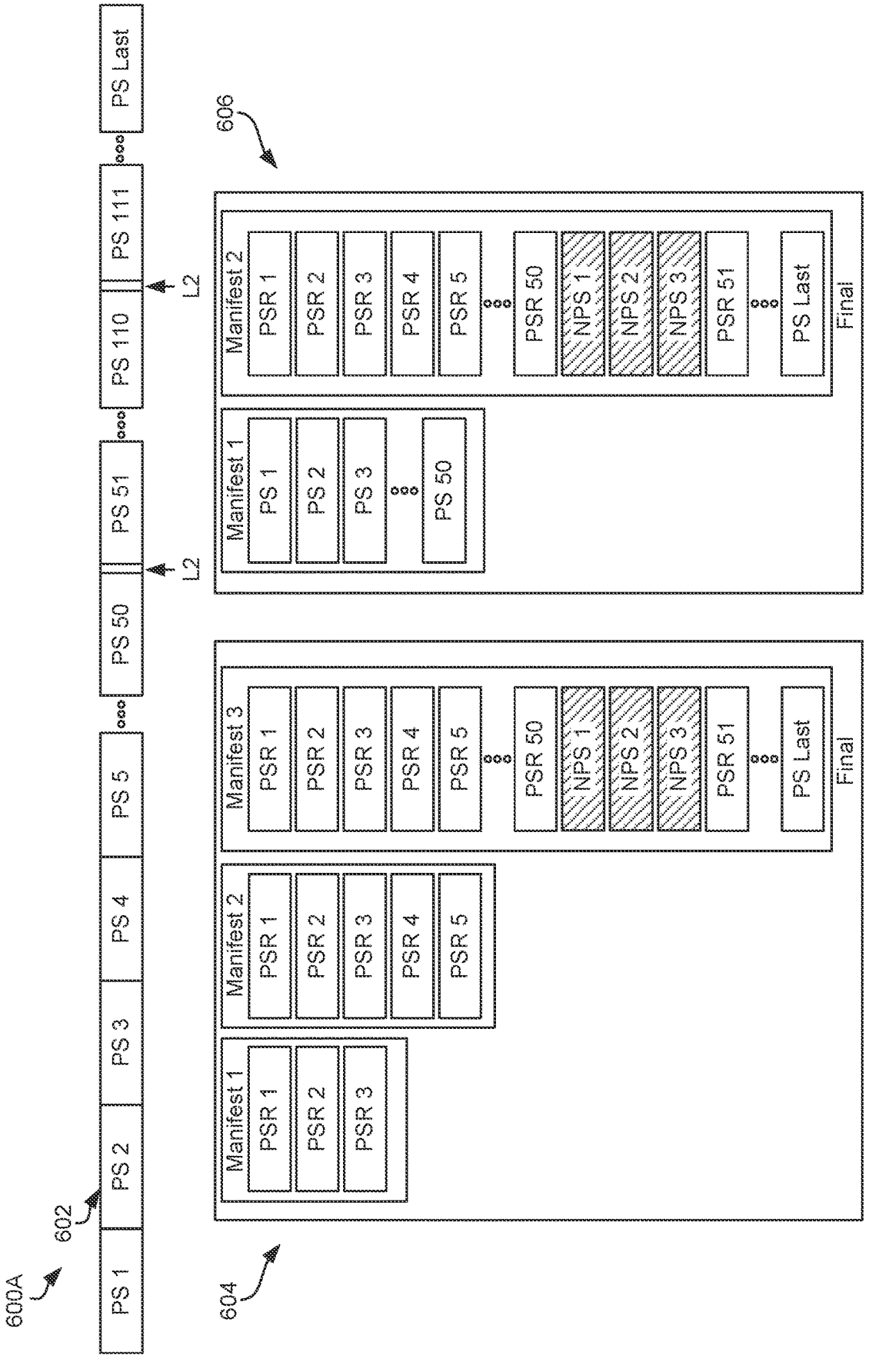

600A
602
604
606
PS 1
PS 2
PS 3
PS 4
PS 5
PS 50
PS 51
PS 110
PS 111
PS Last
L2
L2
Manifest 1
PSR 1
PSR 2
PSR 3
Manifest 2
PSR 1
PSR 2
PSR 3
PSR 4
PSR 5
Manifest 3
PSR 1
PSR 2
PSR 3
PSR 4
PSR 5
PSR 50
NPS 1
NPS 2
NPS 3
PSR 51
PS Last
Final
Manifest 1
PS 1
PS 2
PS 3
PS 50
Manifest 2
PSR 1
PSR 2
PSR 3
PSR 4
PSR 5
PSR 50
NPS 1
NPS 2
NPS 3
PSR 51
PS Last
Final

FIG. 6A

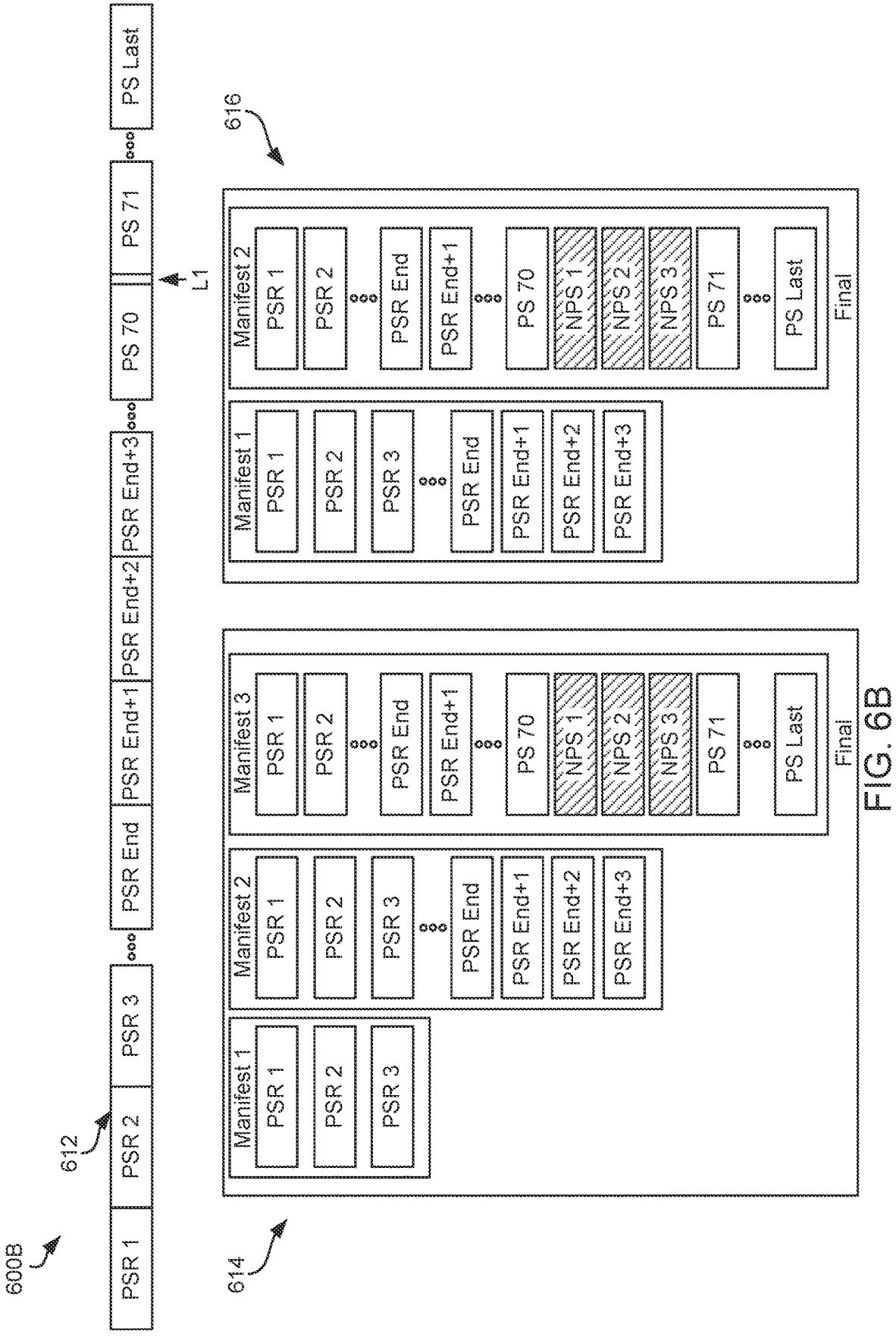

600B
612
614
616
L1
PSR 1
PSR 2
PSR 3
PSR End
PSR End+1
PSR End+2
PSR End+3
PS 70
PS 71
PS Last
Manifest 1
Manifest 2
Manifest 3
NPS 1
NPS 2
NPS 3
Final

FIG. 6B

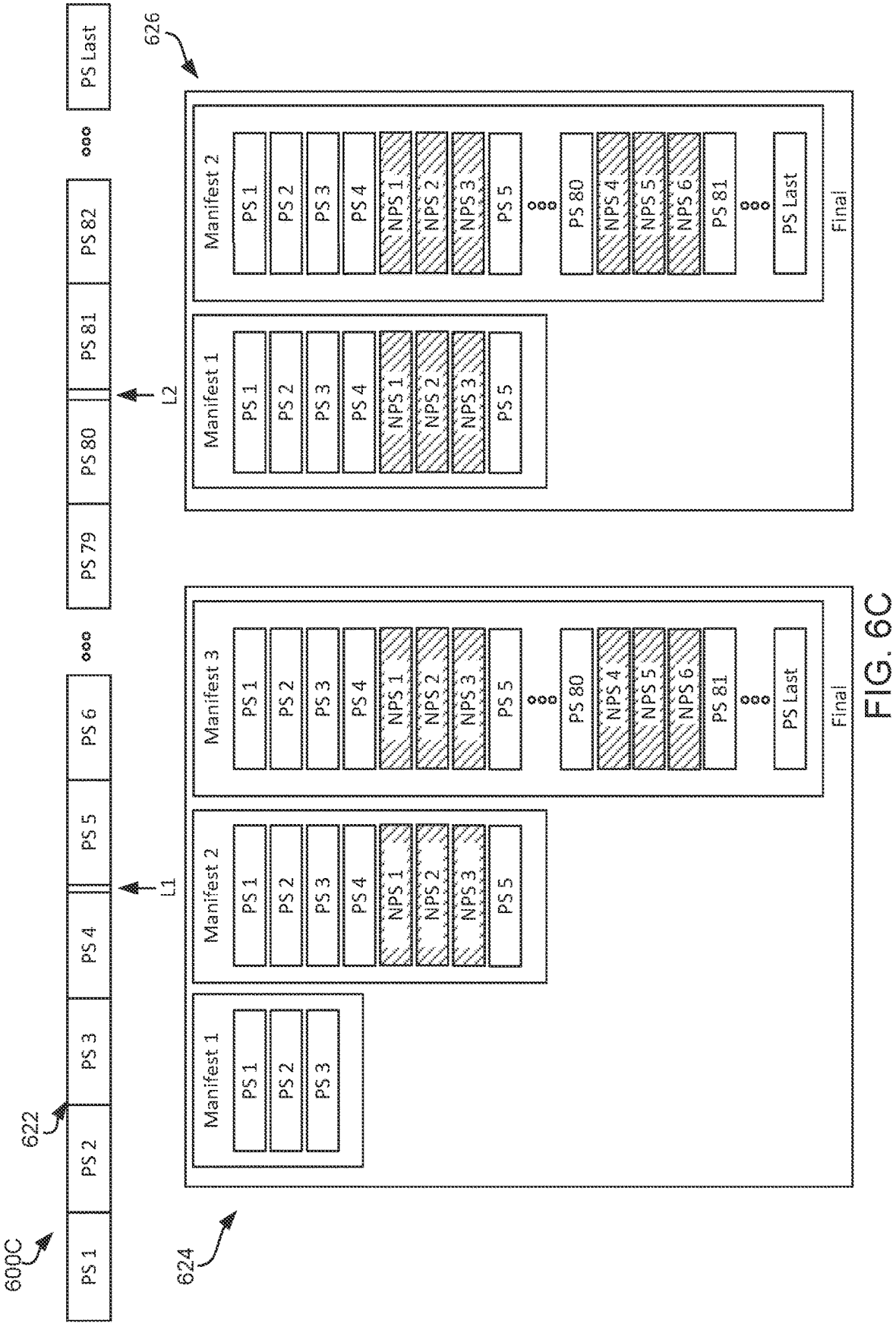

600C
PS 1
PS 2
PS 3
PS 4
PS 5
PS 6
PS 79
PS 80
PS 81
PS 82
PS Last
622
624
626
L1
L2
Manifest 1
Manifest 2
Manifest 3
Final
NPS 1
NPS 2
NPS 3
NPS 4
NPS 5
NPS 6

FIG. 6C

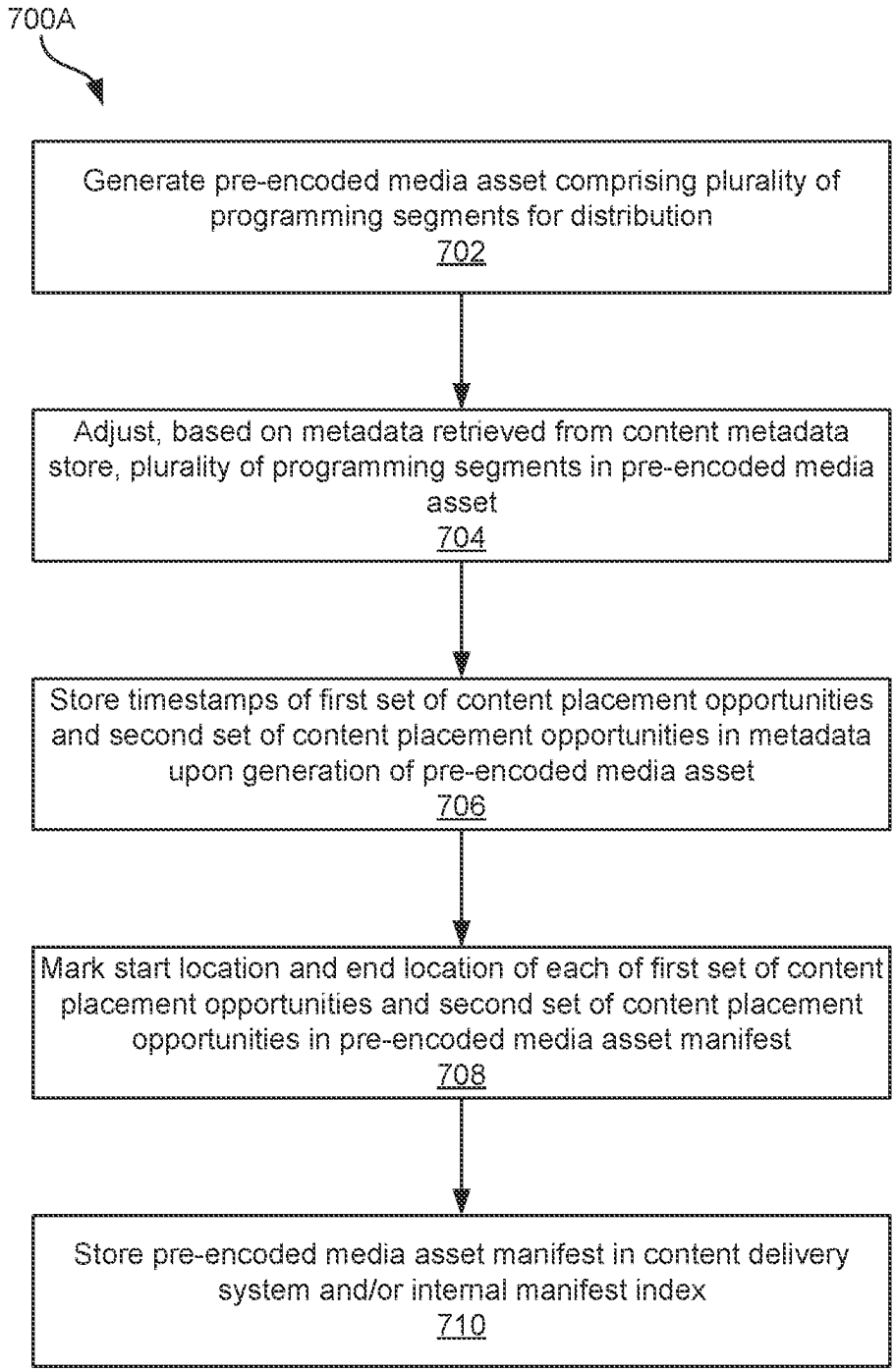

700A
Generate pre-encoded media asset comprising plurality of programming segments for distribution
702
Adjust, based on metadata retrieved from content metadata store, plurality of programming segments in pre-encoded media asset
704
Store timestamps of first set of content placement opportunities and second set of content placement opportunities in metadata upon generation of pre-encoded media asset
706
Mark start location and end location of each of first set of content placement opportunities and second set of content placement opportunities in pre-encoded media asset manifest
708
Store pre-encoded media asset manifest in content delivery system and/or internal manifest index
710

FIG. 7A

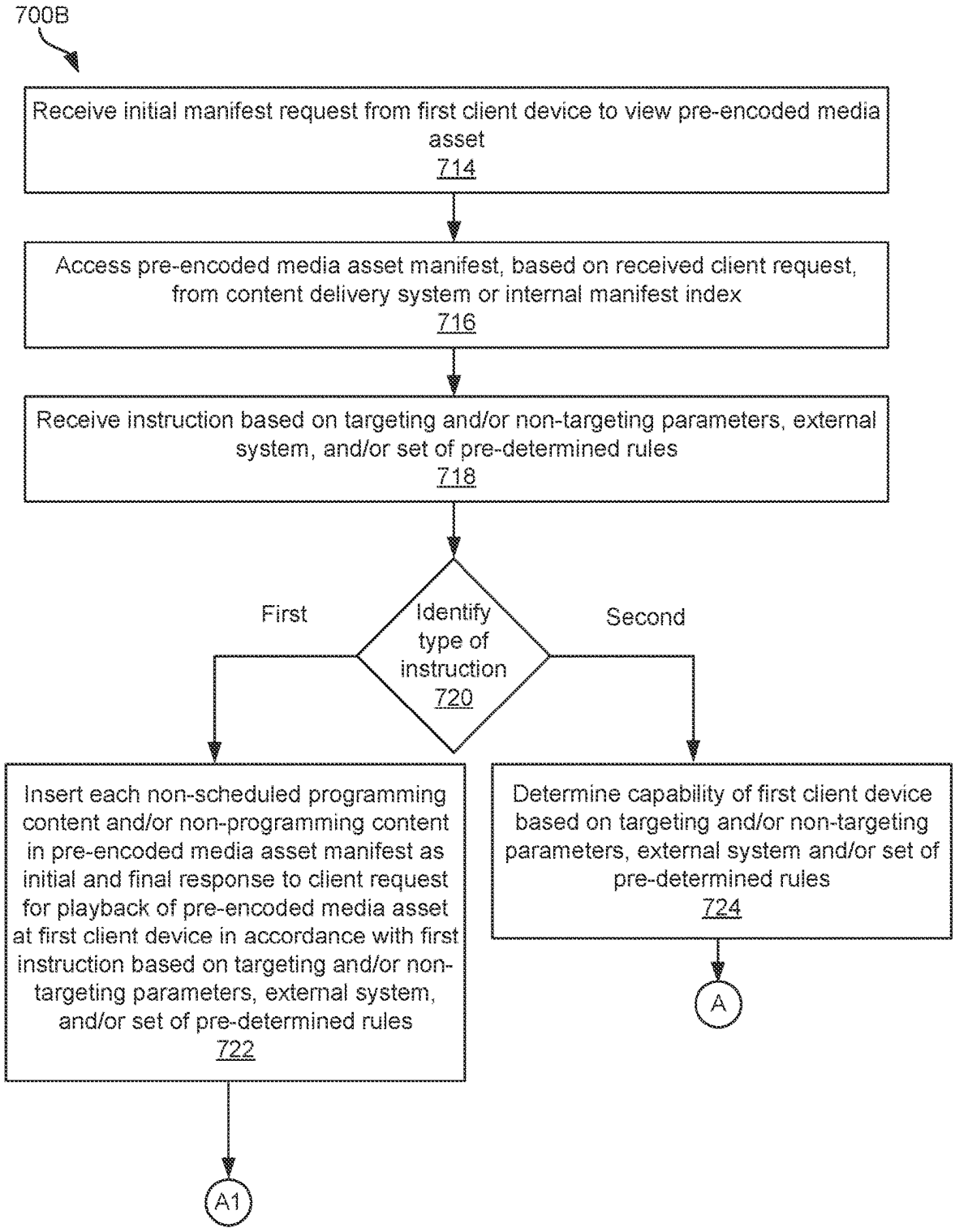

700B
Receive initial manifest request from first client device to view pre-encoded media asset
714
Access pre-encoded media asset manifest, based on received client request, from content delivery system or internal manifest index
716
Receive instruction based on targeting and/or non-targeting parameters, external system, and/or set of pre-determined rules
718
Identify type of instruction
720
First
Second
Insert each non-scheduled programming content and/or non-programming content in pre-encoded media asset manifest as initial and final response to client request for playback of pre-encoded media asset at first client device in accordance with first instruction based on targeting and/or non-targeting parameters, external system, and/or set of pre-determined rules
722
Determine capability of first client device based on targeting and/or non-targeting parameters, external system and/or set of pre-determined rules
724
A
A1

FIG. 7B

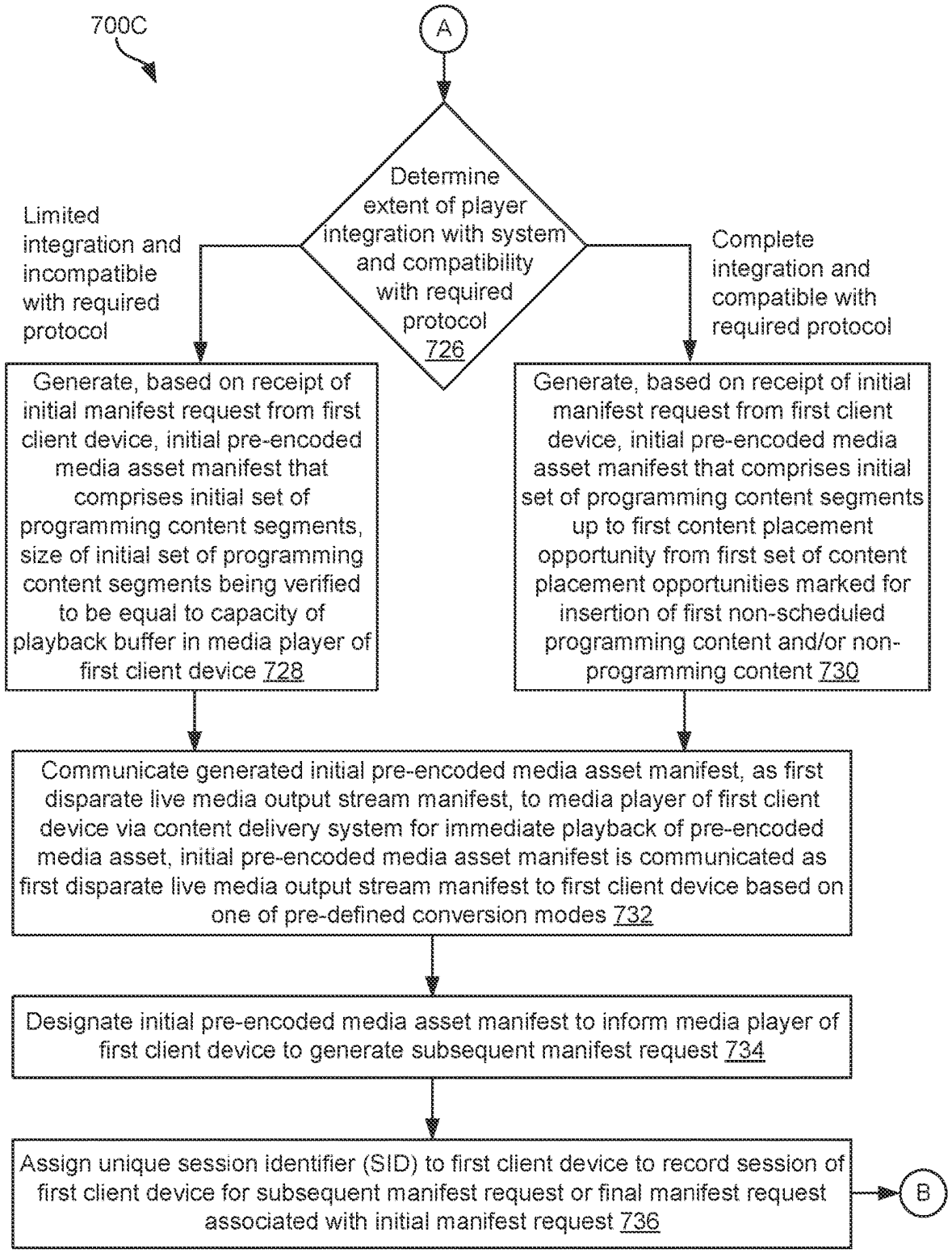

700C
A
Determine extent of player integration with system and compatibility with required protocol 726
Limited integration and incompatible with required protocol
Complete integration and compatible with required protocol
Generate, based on receipt of initial manifest request from first client device, initial pre-encoded media asset manifest that comprises initial set of programming content segments, size of initial set of programming content segments being verified to be equal to capacity of playback buffer in media player of first client device 728
Generate, based on receipt of initial manifest request from first client device, initial pre-encoded media asset manifest that comprises initial set of programming content segments up to first content placement opportunity from first set of content placement opportunities marked for insertion of first non-scheduled programming content and/or non-programming content 730
Communicate generated initial pre-encoded media asset manifest, as first disparate live media output stream manifest, to media player of first client device via content delivery system for immediate playback of pre-encoded media asset, initial pre-encoded media asset manifest is communicated as first disparate live media output stream manifest to first client device based on one of pre-defined conversion modes 732
Designate initial pre-encoded media asset manifest to inform media player of first client device to generate subsequent manifest request 734
Assign unique session identifier (SID) to first client device to record session of first client device for subsequent manifest request or final manifest request associated with initial manifest request 736
B

FIG. 7C

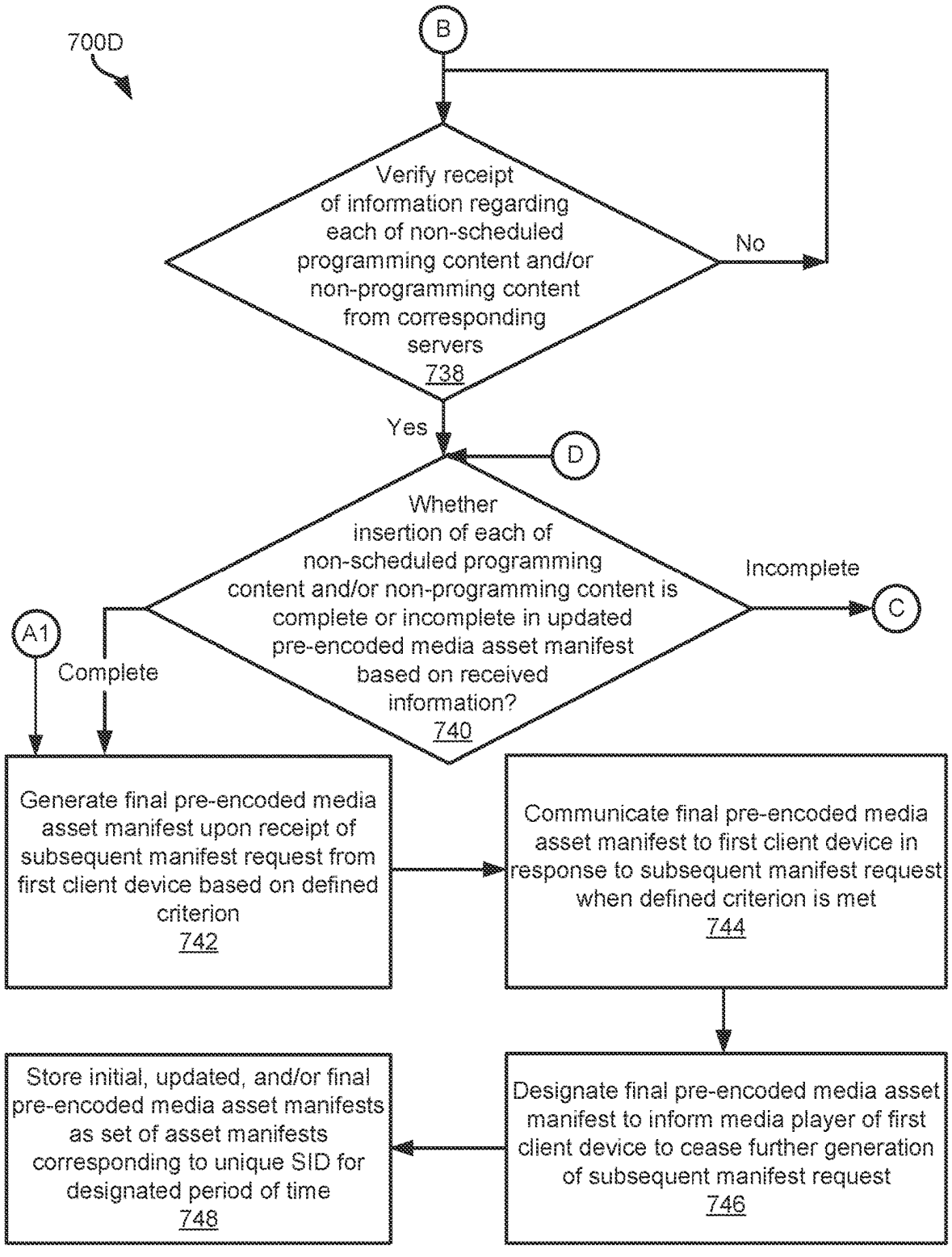

700D
B
Verify receipt of information regarding each of non-scheduled programming content and/or non-programming content from corresponding servers
738
No
Yes
D
Whether insertion of each of non-scheduled programming content and/or non-programming content is complete or incomplete in updated pre-encoded media asset manifest based on received information?
740
Incomplete
C
A1
Complete
Generate final pre-encoded media asset manifest upon receipt of subsequent manifest request from first client device based on defined criterion
742
Communicate final pre-encoded media asset manifest to first client device in response to subsequent manifest request when defined criterion is met
744
Designate final pre-encoded media asset manifest to inform media player of first client device to cease further generation of subsequent manifest request
746
Store initial, updated, and/or final pre-encoded media asset manifests as set of asset manifests corresponding to unique SID for designated period of time
748

FIG. 7D

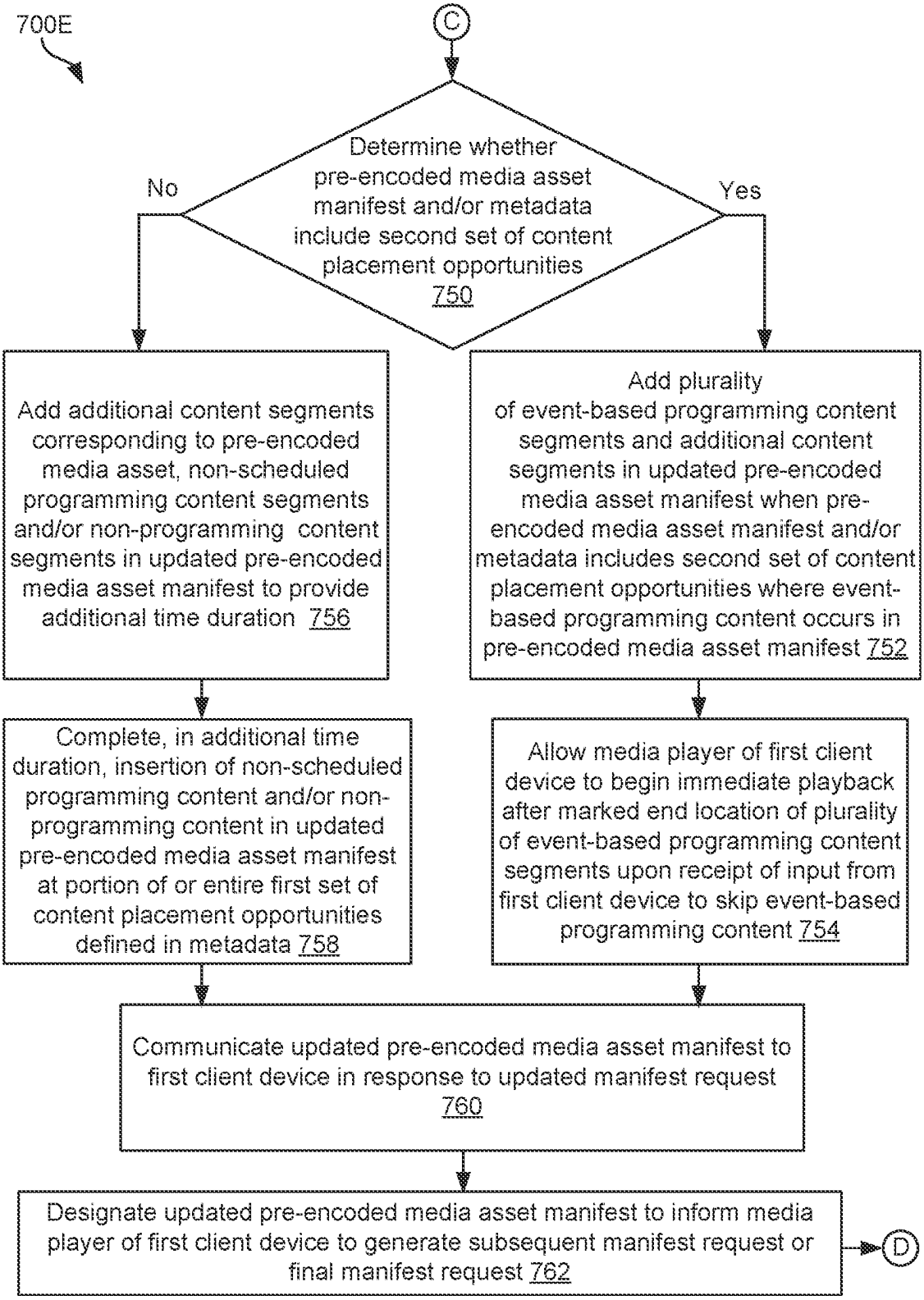

700E
C
Determine whether pre-encoded media asset manifest and/or metadata include second set of content placement opportunities 750
No
Yes
Add additional content segments corresponding to pre-encoded media asset, non-scheduled programming content segments and/or non-programming content segments in updated pre-encoded media asset manifest to provide additional time duration 756
Add plurality of event-based programming content segments and additional content segments in updated pre-encoded media asset manifest when pre-encoded media asset manifest and/or metadata includes second set of content placement opportunities where event-based programming content occurs in pre-encoded media asset manifest 752
Complete, in additional time duration, insertion of non-scheduled programming content and/or non-programming content in updated pre-encoded media asset manifest at portion of or entire first set of content placement opportunities defined in metadata 758
Allow media player of first client device to begin immediate playback after marked end location of plurality of event-based programming content segments upon receipt of input from first client device to skip event-based programming content 754
Communicate updated pre-encoded media asset manifest to first client device in response to updated manifest request 760
Designate updated pre-encoded media asset manifest to inform media player of first client device to generate subsequent manifest request or final manifest request 762
D

FIG. 7E

METHOD AND SYSTEM FOR MANAGING A PRE-ENCODED MEDIA ASSET FOR IMMEDIATE PLAYBACK

CROSS-REFERENCE TO RELATED APPLICATIONS/INCORPORATION BY REFERENCE

This Patent Applications is a Continuation-in-part of U.S. patent application Ser. No. 17/094,319, filed on Nov. 10, 2020, which is a continuation of U.S. patent application Ser. No. 16/234,870, filed on Dec. 28, 2018, which is further a Continuation-in-part of U.S. patent application Ser. No. 15/396,475, filed on Dec. 31, 2016, and claims priority to, and the benefit from U.S. Provisional Application Ser. No. 62/699,131, filed Jul. 17, 2018.

This Application Also Makes Reference to:

- U.S. application Ser. No. 15/988,241, filed on May 24, 2018, now U.S. Pat. No. 10,924,804;
- U.S. application Ser. No. 16/229,310, filed on Dec. 21, 2018, now U.S. Pat. No. 11,019,384;
- U.S. application Ser. No. 16/229,497, filed on Dec. 21, 2018;
- U.S. application Ser. No. 16/235,445, filed on Dec. 28, 2018, now U.S. Pat. No. 10,992,973; and
- U.S. application Ser. No. 16/236,673, filed on Dec. 31, 2018, now U.S. Pat. No. 10,856,016.

Each of the above referenced patent applications is hereby incorporated herein by reference in its entirety.

FIELD OF TECHNOLOGY

Certain embodiments of the disclosure relate to a television content packaging and distribution system. More specifically, certain embodiments of the disclosure relate to a method and system for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, and for managing a pre-encoded media asset for immediate playback.

BACKGROUND

Recent advancements in the field of television content packaging and distribution systems have led to a massive development of numerous technologies and broadcasting platforms that are revolutionizing the way consumer devices access and playout media content. Usually, broadcasting platforms refer to the types of networks that are used to deliver the media content to the consumers. Currently, the broadcasting platforms, such as analog terrestrial broadcast, digital terrestrial broadcast, direct-to-home satellite broadcast, cable, Internet Protocol (IP), and over-the-top television (OTT), compete and strive to increase their appeal by gaining and retaining the audience viewing the media content.

Modern streaming protocols, such as HTTP Live Streaming (HLS) and Dynamic Adaptive Streaming over HTTP (DASH), are implemented to support streaming of various live content services, such as DIRECTV NOW^{SM}, SLING TV^{SM} and PLAYSTATION™ VUE, to consumer devices. Due to dissemination of such modern streaming protocols in the television, radio, and broadcasting sector, it is evident that the success of broadcasting will be dependent on the ability of the network provider to gain access to the content that consumers demand, and to differentiate their offering from that of incumbent broadcasters or find breakthrough modes of media content delivery.

Existing systems for Server-Side Ad Insertion (SSAI) support live streaming and make decisions to insert non-programing content in near real-time. However, for On-Demand streaming, such decisions to insert non-programing content are made upfront. Accordingly, amount of control the user can excerpt to influence what non-programming content is shown may get limited.

Further, leveraging the SSAI to insert the non-programming content into a Video On-Demand (VOD) manifest introduces delay in delivering the VOD manifest to a player of a client device, thus negatively affecting the viewer experience. Such a delay may be impacted by various factors, such as the number of advertisement breaks in the VOD content and use of multiple programmatic advertisement decision servers.

Various systems and methods are being implemented to manage such delays. One method may be to hide the delay (introduced by an advertisement insertion process) by playing a brand logo while the advertisement insertion process is being completed. However, such systems and methods fail to address the goal of making the first frame of the VOD content available to the viewer in minimal time. Other systems and methods are being implemented to treat the VOD asset as if it were a live stream. Accordingly, instead of inserting all the advertisements at the very beginning of the VOD manifest, the advertisements may be inserted as they are encountered in the timeline. However, such systems and methods introduce higher costs as the client session must be maintained for the complete duration of the VOD asset. Besides, the viewer experience may also get complicated as various play modes may not be supported without a significantly more complicated player-SSAI system integration.

Further limitations and disadvantages of conventional and traditional approaches will become apparent to one of skill in the art, through comparison of such systems with some aspects of the present disclosure as set forth in the remainder of the present application with reference to the drawings.

BRIEF SUMMARY OF THE DISCLOSURE

Systems and/or methods are provided for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, and for managing a pre-encoded media asset for immediate playback, substantially as shown in and/or described in connection with at least one of the figures, as set forth more completely in the claims.

These and other advantages, aspects and novel features of the present disclosure, as well as details of an illustrated embodiment thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

FIG. **1**A is a block diagram that illustrates an exemplary system for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, and for managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure.

FIG. **1**B is a block diagram that illustrates an exemplary dynamic ad/content insertion system (DACIS) for publish-

ing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, in accordance with an exemplary embodiment of the disclosure.

FIG. **1**C is another block diagram that illustrates an exemplary system for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, and for managing a pre-encoded media asset for immediate playback, in accordance with another exemplary embodiment of the disclosure.

FIG. **1**D is a block diagram that illustrates an exemplary system for managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure.

FIG. **2** illustrates segmentation of live input streams and pre-encoded media assets for a first programming schedule for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content by the DACIS of FIG. **1**B, in accordance with an exemplary embodiment of the disclosure.

FIG. **3** illustrates an exemplary scenario associated with publishing a disparate live media output stream by the DACIS of FIG. **1**B, in accordance with an exemplary embodiment of the disclosure.

FIGS. **4**A to **4**D collectively depict a flowchart illustrating exemplary operations for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content by the DACIS of FIG. **1**B, in accordance with an exemplary embodiment of the disclosure.

FIG. **5**A is a conceptual diagram illustrating an example of a hardware implementation for the DACIS employing a processing system for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, in accordance with an exemplary embodiment of the disclosure.

FIG. **5**B is a conceptual diagram illustrating an example of a hardware implementation for the system employing a processing system for managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure.

FIG. **6**A illustrates a first exemplary scenario associated with managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure.

FIG. **6**B illustrates a second exemplary scenario associated with managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure.

FIG. **6**C illustrates a third exemplary scenario associated with managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure.

FIGS. **7**A to **7**E collectively depict a flowchart illustrating exemplary operations for managing a pre-encoded media asset for immediate playback by the SSAI system of FIG. **1**D, in accordance with an exemplary embodiment of the disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

Certain embodiments of the disclosure may be found in a method and system for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, and for managing a pre-encoded media asset for immediate playback. Various embodiments of the disclosure provide a method and system that not only provide live channel offerings in cost-effective manner but also provide enhanced, intelligent, and personalized viewer experience to increase their appeal by retaining the audience viewing the media content. Additional embodiments of the disclosure provide a method and system for managing the pre-encoded media asset to allow a media player of a first client device to receive a first frame of media corresponding to the pre-encoded media asset for immediate playback, while also not incurring the cost of sustaining a client session for the entire duration of the pre-encoded media asset.

Modern streaming protocols, such as HLS and DASH, break media content into numerous small media content segments, typically less than 10 seconds in length. Further, the modern streaming protocols implement manifests that instruct a media player on what media content segment to retrieve and play next. The manifest may enlist the media segments that make up the full length of the media asset. The manifest may include information, based on which the media player at a consumer device may be able to determine the media segments. The manifest and/or media content segment may also include and/or specify additional information to facilitate a media player to transition smoothly between media content streams from different sources. The manifest may be used for creating a playlist of multiple media content files, or for interrupting media content with advertising and then resuming the media content.

Such modern streaming protocols support video-on-demand (VOD) assets and live content as well. The VOD assets prepared for distribution, for example Internet distribution, may have a sequence of short duration segments added to a manifest. The short duration segments may be separate physical files or pointers (real or to be calculated) to the short media content segments inside a larger file. On the other hand, in case of live content, new short content media segments are made available as soon as they are created. In some protocols, each new segment is added to a manifest while in others the media player is provided with information that may be utilized to calculate what the next live segment will be. In the latter case, a signal in the media content itself may be utilized to inform the player when to re-inspect or check the manifest for a change in media content. In live streaming, delivery of live content is supported by making available each new short media content segments as soon as such media content segments are generated. In some protocols, new media content segments may be added to the manifest, while in others, the media player calculates necessary information about the next live media content segments.

In accordance with various embodiments of the disclosure, a system is provided for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content. One or more processors in the system may be configured to receive a first manifest request from a first client device, wherein the first manifest request comprises one or more parameters. The one or more processors in the system may be further configured to determine a first additional content that comprises a customized first programming content and a targeted first non-programming content for the first client device based on the one or more parameters and the associated indexed metadata. The one or more processors in the system may be further configured to

generate a first programming schedule for the first client device based on the selected one or more live input streams and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content. Accordingly, one or more live input stream manifests and/or one or more pre-encoded media asset manifests published in a content delivery network and associated indexed metadata may be selected based on the one or more parameters. The one or more processors in the system may be further configured to publish a first disparate live media output stream manifest for the first client device based on insertion of the selected one or more live input stream manifests and/or the one or more pre-encoded media asset manifests, the associated indexed metadata, and the determined first additional content in accordance with the first programming schedule generated for the first client device.

In accordance with another aspect of the disclosure, a system is provided for managing a pre-encoded media asset for immediate playback. One or more processors in the system may be configured to generate, based on a receipt of an initial manifest request from a first client device, an initial pre-encoded media asset manifest that comprises an initial set of programming content segments. The one or more processors in the system may be further configured to communicate the generated initial pre-encoded media asset manifest, as a first disparate live media output stream manifest, to a media player of the first client device via a content delivery system for an immediate playback of a pre-encoded media asset. The one or more processors in the system may be further configured to assign a unique session identifier (SID) to the first client device to record a session of the first client device for a subsequent manifest request or a final manifest request associated with the initial manifest request. The one or more processors in the system may be further configured to generate a final pre-encoded media asset manifest upon a receipt of the subsequent manifest request from the first client device based on a defined criterion. The final pre-encoded media asset manifest may comprise remaining programming content segments corresponding to the pre-encoded media asset, non-scheduled programming content segments corresponding to each non-scheduled programming content, and non-programming content segments corresponding to each non-programming content based on targeting and/or non-targeting parameters.

FIG. **1**A is a block diagram that illustrates an exemplary system for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, and for managing a pre-encoded media asset for immediate playback, in accordance with exemplary embodiments of the disclosure. Referring to FIG. **1**A, the system **100**A, comprises a media packaging and distribution system **102** that is communicatively coupled to published data sources **104***a*, . . . , **104***n*, Ad decisioning servers **106***a*, . . . , **106***n*, via a network **108** and/or other programmatic means. There are shown consumer devices **110***a*, . . . , **110***n* that are communicatively coupled to the network **108**. The media packaging and distribution system **102** may comprise at least a DACIS **103**, a Content Decisioning Service (CDS) **105**, a Content Packaging and Distribution System (CPDS) **107**, a stream selection service **142**, and a repository of schedules, rights, and user preferences database **144**. There are also shown source devices **118** communicatively coupled to the media packaging and distribution system **102** through the network **108**. An external data source **120** is also provided, which is communicatively coupled to the media packaging and distribution system **102** through the network **108**.

In accordance with another aspect of the disclosure, the DACIS **103** may include a server-side ad insertion (SSAI) system **109**. As discussed in the present disclosure, the DACIS **103** corresponds to a system that is configured to dynamically insert targeted non-programming content (such as advertisements) and customized programming content (such as alternative programs) in a given manifest and generates a disparate per-client live media output stream. On the other hand, the SSAI system **109** corresponds to a system that is configured to only insert targeted non-programming content and/or non-scheduled programming content in the given manifest. Thus, in accordance with a first embodiment, as described above, the SSAI system **109** in FIG. **1**A is illustrated as a subset of the DACIS **103** and may be implemented within the DACIS **103**. Notwithstanding, the illustrated arrangement of the SSAI system **109** within the DACIS **103** in FIG. **1**A should not be construed to be limiting. Another arrangement, in accordance with a second embodiment, may be implemented in the system **100**C as illustrated in FIG. **1**C, without any deviation from the scope of the disclosure. In accordance with the second embodiment, the SSAI system **109** may be implemented separately from the DACIS **103**.

The media packaging and distribution system **102** may comprise suitable logic, circuitry, and interfaces that may be configured to execute code that handles media content comprising audio, video, images, metadata, manifests, and/or other data (embedded and/or externally referenced). The media content may include a video, an audio, a combination of audio and video presentations, and/or embedded or externally referenced metadata, a combination of multiple-audio, multiple-video, and/or embedded or externally referenced metadata. Accordingly, the media packaging and distribution system **102** publishes a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content.

In this regard, the media packaging and distribution system **102** may provide video programming services to viewers, usually for a subscription fee (such as pay television). The media packaging and distribution system **102** also handles distribution, for example, multicasting, unicasting, broadcasting, streaming, for one or more channels to be viewed on one or more of the plurality of consumer devices **110***a*, . . . , **110***n*.

The media packaging and distribution system **102** may be operated by an entity related to handling or distribution of media content, for example, a broadcast provider or operator, or a network provider or network operator. The entity related to handling or distribution of media content may also be referred to as a content owner, a distributor, a syndicator, a re-distributor, a content aggregator, a search, discovery, or cataloging service provider, or any other entity actively or passively involved with the distribution, cataloging, or referencing of complete or partial presentations of media content. Throughout this document, the terms broadcast provider or broadcast operator, and network provider or network operator may be utilized to refer to the entity related to handling or distribution of media content, interchangeably. The broadcast provider may handle a single channel or a plurality of channels, or one or more networks. The broadcast provider may be configured to distribute content via one or more platforms, for example, traditional over-the-air broadcast channels, radio, cable television networks, satellite communication networks, the Internet, and/or other

content delivery networks (CDNs). In this regard, the broadcast provider may be configured to execute code that communicates linear video feeds (also referred to as a network television feed or broadcast feed) to the media packaging and distribution system **102**. In a broadcast chain, the broadcast provider may receive actual content, for example, from a production studio, in one or more source formats. Examples of the one or more source formats may include, but are not limited to a tape file, or a live feed that may be further converted to a serial digital interface (SDI) video interface and/or on a high-definition SDI (HD-SDI) video interface for processing and playout. The broadcast provider may further process the content, such as insertion of graphics, closed captions, preparation of programming schedule, insertion of triggers, and the like, and provide final delivery by a broadcasting apparatus. The communicated linear video feed and the playout schedule may correspond to a channel, such as CNN channel that is broadcast to the media packaging and distribution system **102**, via a communication network. The linear video feed may be broadcasted as a multi-program transport stream (MPTS) (also referred to as a live video feed) to the media packaging and distribution system **102**, via the network **108**. The broadcast provider may be owned by (or associated to) a broadcast provider or operator, a network provider or operator, or a content provider or operator.

The media packaging and distribution system **102** may receive the MPTS, which includes the signaling content and metadata, from the broadcast provider based on, for example, current society of cable telecommunication engineers (SCTE) standards (SCTE-35 and SCTE-224) to control web and regional blackouts, network end of day switching, and advertisement insertion. For example, the media packaging and distribution system **102** may be signaled for various blackout types with in-band SCTE-35 message. Further, the media packaging and distribution system **102** may receive program metadata that specifies certain events or operations, such as, for example, when to blackout shows. Examples of legacy distribution system that may be benefitted from the media packaging and distribution system **102** may include direct-broadcast satellite (DBS) providers, cable television (CATV) systems, and other wireline video providers and competitive local exchange carriers (CLECs) using, for example, IPTV.

The DACIS **103** may comprise suitable logic, circuitry, and interfaces that may be configured to leverage one-to-one scale of traditional SSAI systems to support custom programming content choices and not just targeted non-programming content. For example when the user selects to join a live stream, a content decisioning system, such as the CDS **105** could determine that, instead of joining the live stream for the last few minutes of a program prior to the start of the intended program, the user should instead be shown content more relevant to the user so as to prevent them from tuning away, e.g. show a personalized set of basketball highlights and ads to a user who likely joined the stream to watch a basketball game that is coming on next. The DACIS **103** replaces original content in the live stream prior to game start with user relevant content, such that upon its conclusion, the user is seamlessly presented the game.

The DACIS **103** may be further configured to, via a programming schedule or tag indicator in a disparate live media output stream manifest, be notified of one or more content graphical treatment opportunities within the media content. The DACIS **103** may be further configured to make required non-programing content calls on behalf of the plurality of consumer devices **110***a*, . . . , **110***n*. Accordingly, the DACIS **103** may provide the plurality of consumer devices **110***a*, . . . , **110***n* with information needed to execute the graphical treatment graphical content via a secure out-of-band channel between the DACIS **103** and the plurality of consumer devices **110***a*, . . . , **110***n*. In accordance with an embodiment, the DACIS **103** may be configured to include not showing non-programming content that a user of a consumer device may elected to skip or rated poorly in an earlier non-programming content break. Further, the DACIS **103** may enable the user to skip non-programming content as the user interacted with a previous non-programming content or made a purchase and the advertiser elected to sponsor the remainder of the programming content.

In accordance with an embodiment, the DACIS **103** may be configured to provide seamless failover between redundant disparate live media output streams for large events, thus improving reliability. In certain instances, some of the plurality of consumer devices **110***a*, . . . , **110***n* may support a primary and backup disparate live media output streams and are able to fail between them. In other instances, others of the plurality of consumer devices **110***a*, . . . , **110***n* may not support the primary and backup disparate live media output streams. In such instances, the consumer devices may attempt to join an alternative disparate live media output stream after occurrence of an event such as a device failure or crash. For such consumer devices, the DACIS **103** may be configured to monitor both the primary and backup disparate live media output streams, and if there is a failure, write the alternative disparate live media output stream into the disparate live media output stream manifest.

Each of the plurality of published data sources **104***a*, . . . , **104***n* may be coupled to one or more television networks and may comprise suitable logic, circuitry, and interfaces that may be configured to execute code that provides actual audiences for programs that were distributed. As illustrated in FIG. **1**A, the plurality of published data sources **104***a*, . . . , **104***n* are coupled to the media packaging and distribution system **102** via the network **108** and configured to monitor audience drift to or away from a tuned channel airing a live media output stream. The plurality of published data sources **104***a*, . . . , **104***n* may provide actual audiences for programs to the indexing and storage system **116**. An exemplary published data source may be Nielsen. Nielsen has the capability to determine when a viewer watches the same set of media items, for example, advertisements and/or promotional content, in programming data, such as an episode, in a live video feed within 3 days of original airing, and provide Nielsen "C3" credit. Another exemplary published data source may be a published database that provides ratings for a media item, such as gross rating point (GRP). The GRP is advertising or promotion impact measure for each advertising and/or promotional campaigns, known in the art. Other exemplary published data sources may also include direct/indirect access to other public or private data sources (persistent or ephemeral) through programmatic means.

The CDS **105** may comprise suitable logic, circuitry, and interfaces that may be configured to determine, upon request, which programming content (or partial programming content) to deliver back to the plurality of consumer devices **110***a*, . . . , **110***n*. Thus, the CDS **105** may be configured to insert additional content (including non-programming content) or replace existing content, according to one or more parameters provided by the plurality of consumer devices **110***a*, . . . , **110***n* and data stored in various external systems and/or databases.

The Ad decisioning servers **106***a*, . . . , **106***n* may comprise suitable logic, circuitry, and interfaces that may be config-

ured to implement at least an advertisement decisioning component that may be used during a real-time content or advertisement placement activity, for example during dynamic ad insertion. The Ad decisioning servers **106***a*, . . . , **106***n* may further determine ad-load opportunity, based on targeting data from schedules, rights, and user preferences database.

For example, commercial or non-commercial advertisements may be dynamically inserted within program segments of the live input streams based on the detected upcoming indicator, such as an inbound trigger, a signaling point, and/or a signal in a pre-encoded media asset and/or a live input stream by the Ad decisioning servers **106***a*, . . . , **106***n*.

In an embodiment, the DACIS **103** may be generalized as a proxy between the plurality of consumer devices **110***a*, . . . , **110***n* and the Ad decisioning servers **106***a*, . . . , **106***n*. In one implementation, a request is sent from a consumer device to the DACIS **103**. The DACIS **10** may call on of the Ad decisioning servers **106***a*, . . . , **106***n* to determine a set of non-programming content that may be inserted into the disparate live media output stream.

The CPDS **107** may comprise suitable logic, circuitry, and interfaces that may be configured to index programming content, which is prepared for usage by a system, such as the stream publishing engine **114**. The CPDS **107** may further define metadata detailing various facets of the programming and/or non-programing content including duration, known locations and opportunities for programing and/or non-programing content insertion/replacement.

The network **108** may be any kind of network, or a combination of various networks, and it is shown illustrating exemplary communication that may occur between the Ad decisioning servers **106***a*, . . . , **106***n* and the media packaging and distribution system **102**. For example, the network **108** may comprise one or more of a cable television network, the Internet, a satellite communication network, a wide area network (WAN), a medium area network (MAN), and a local area network (LAN). Although a network **108** is shown, the disclosure is not limited in this regard; accordingly, other exemplary modes may comprise uni-directional or bi-directional distribution, such as packet-radio, satellite. Furthermore, the network **108** is an exemplary embodiment of a distribution system.

The SSAI system **109** may comprise suitable logic, circuitry, and interfaces that may be configured to insert non-scheduled programming content and/or non-programming content, such as advertisements, into playback instructions associated with a video on-demand asset or a pre-encoded media asset in accordance with the modern web streaming protocols. The SSAI system **109** may enable the non-scheduled programming content and/or the non-programming content to be targeted to individual client devices while maintaining clean transitions between content, such as programming content segments of the pre-encoded media asset, and the non-scheduled programming content and/or the non-programming content while also obfuscating the non-programming content from being blocked.

The consumer devices **110***a*, . . . , **110***n* may refer to end-user devices or consumption devices where the content is played to be consumed by a user. The number of impressions of a media item, such as an advertisement and/or promotional media, on such plurality of consumer devices **110***a*, . . . , **110***n* determines the advertising impact or promotion impact and number of actual audiences achieved during campaigns. Examples of the consumer devices **110***a*, . . . , **110***n* may include, but are not limited to, connected TVs, connected TV with paired and/or connected devices (e.g., HDMI sticks, tablets), personal computer, smartphone, tablet, OTT set-top, or hybrid set-top, and second screen devices such as smartphones, tablets, game consoles, personal computers, set-top boxes, and embedded devices. The consumer devices **110***a*, . . . , **110***n* may further include process/system that may process the output for any means, regardless of the capability or intent to decode for media presentation, and on which the consumer may launch a web page, a web application, or a web service to view media content.

The source devices **118** may comprise suitable logic, circuitry, and interfaces that may be configured to communicate a live media feed or live input streams of a channel, such as an existing channel, to the media packaging and distribution system **102**. In accordance with an embodiment, the live input streams of the channel may correspond to a broadcast feed. The source device **118** may be communicatively coupled to the network **108**.

The external data source **120** may comprise suitable logic, circuitry, and interfaces that may be configured to execute code that handles retrieval and storage of audience data that corresponds to subscribers of the plurality of consumer devices **110***a*, . . . , **110***n*. The audience data may include demographics data, audience targeting data, trending data, device type data, device platform data, and content recognition-based data, such as automatic content recognition (ACR)-based data. The trending data may comprise information on what's trending in the social networks (or platforms), such as Twitter®, Facebook®, and the like. The trending data also comprises information on what's trending based on social engagement, such as number of likes or votes to a particular media item, or number of people watching a particular media item. The trending data may indicate an aggregate interest level of a number of users in the social networks for a particular media item. For example, a thousand or more shares, or likes by a number of users may indicate a highly popular media item.

The stream selection service **142** may comprise suitable logic, circuitry, and interfaces that may be configured to execute code that may be configured to provide a consumer device, for example, the consumer device **110***a*, requesting to view the disparate live media output stream with a correct variant of disparate live media output stream, based on the geolocation and identification of the consumer device **110***a*, along with data retrieved from the repository of schedules, rights, and user preferences database **144**.

The repository of schedules, rights, and user preferences database **144** may comprise suitable logic, circuitry, and interfaces that may be configured to store the schedules for all source feeds, availability rights for all the content in the schedules, regional blackout zones for the various sports leagues, predefined location-based viewing preferences, individual client viewing preferences, and any viewing or transition rules provided by the stream owner operator.

In operation, in accordance with an aspect of the disclosure, upon receiving a first manifest request from a consumer device, the DACIS **103** may be configured to publish a manifest of a first disparate live media output stream for the consumer device. The first disparate live media output stream may be chosen by the DACIS **103**, at the time of the first manifest request, to best target a consumer device, according to a plurality of client-specific parameters. The plurality of client-specific parameters may comprise user preferences and identifiers, consumer device preferences and identifiers, and one or more rules/rights governed by geolocation data and current position of playback of a first

disparate live media output stream at the consumer device. The first disparate live media output stream manifest may be generated, at the time of the first manifest request, to include additional content, such as the targeted non-programing content and the customized programming content. Examples of the targeted non-programing content may include, but are not limited to, advertisements, personalized (per-user) advertisements, video advertisements, and graphical treatment (such as overlays). The targeted non-programing content may further include first interactive elements, such as an option to purchase goods or content, and second interactive elements. The second interactive elements may further affect the generation of the first disparate live media output stream manifest by providing various options. For example, a first option may be to skip a given ad, a second option may be to skip future ads for remainder of the playback of the first disparate live media output stream, a third option may be to choose one or more ads of a given category, or a fourth option may be too watch all ads immediately to avoid ads for the remainder of the playback. Examples of the customized programing content may include, but are not limited to, promotional content, short-form content, or alternate content (content replacing that of the requested first disparate live media output stream.

The DACIS **103** may further receive metadata associated with the content and additional content for the first disparate live media output stream from the CPDS **107**. The metadata may include, for example, ad break locations, graphical treatment marker/triggers, SCTE35 markers, content duration, personalized content opportunities, and one or more decision point locations.

In accordance with an embodiment, the DACIS **103** may be configured to convert a pre-encoded media asset to the first disparate live media output stream to facilitate one or more subsequent modifications on the first disparate live media output stream. The one or more subsequent modifications may correspond to a user selection, a user preference, a change in a first programming schedule, or a time or geolocation-based rule. In accordance with an embodiment, the DACIS **103** may be configured to perform another conversion of remainder of the first disparate live media output stream into the one or more pre-encoded media assets to facilitate download of the one or more pre-encoded media assets at the consumer device and mitigate dependency on the DACIS **103** for playback of remaining portion.

In accordance with another aspect of the disclosure, upon receiving the first manifest request, a manifest of the first disparate live media output stream may be altered to include additional or alternate content, apart from the content originally scheduled for playback. The DACIS **103** may be configured to determine which content to include/replace by utilizing one or more parameters. The one or more parameters may include, but not limited to, URL requested for playback, and an identifier referencing a record for an existing first disparate live media output stream or an external connected system, such as the CPDS **107**. The one or more parameters may include a plurality of client-specific parameters that may comprise user preferences and identifiers, consumer device preferences and identifiers, and one or more rules/rights governed by geolocation data and current position of playback of a first disparate live media output stream at the consumer device. The one or more parameters may include a plurality of client-specified attributes derived from user interaction with the consumer device. The plurality of client-specified attributes may include, for example, a preference for a given type and/or category (or categories) of programming content, a possible time constraint or duration to fill with content. The time constraint or duration to fill with content may be determined by user preferences from an external system, such as the repository of schedules, rights, and user preferences database **144**, a range defined in the first client manifest request, schedule tolerances, as defined in the repository of schedules, rights, and user preferences database **144**, device preferences/identifiers declared in the first manifest request, and a prior consumer request, or found in the repository of schedules, rights, and user preferences database **144**. The time constraint or duration to fill with content may be further determined by geolocation information declared in the first manifest request or found in the first manifest request, or external database, such as the repository of schedules, rights, and user preferences database **144**, or external systems, such as a content recommendation engine. The one or more parameters may further include rules, rights, and schedule data stored in the DACIS **103** or an adjacent, external system—such as the repository of schedules, rights, and user preferences database **144**.

In accordance with an embodiment, the DACIS **103** may determine where to place new or alternate content within the requested disparate live media output stream. The DACIS **103** may utilize metadata, such as ad break locations, graphical treatment markers/triggers, SCTE35 markers, content duration, and one or more decision point locations. The metadata may be sourced from a system that has indexed metadata for the asset, such as the CPDS **107**. The DACIS **103** may generate a new schedule from the determined alterations in the first disparate live media output stream. The DACIS **103** may transmit resulting schedule to the stream publishing engine **114** to generate a final disparate live media output stream. The final disparate live media output stream may be delivered back to originating client. The stream publishing engine **114** may generate the first disparate live media output stream manifest based on one of a pre-defined conversion modes. The pre-defined conversion modes may correspond to pre-encoded media assets to live stream mode, pre-encoded media assets to live stream mode with scalable architecture, a live stream to live stream mode, and a mixed mode corresponding to switching between pre-encoded media assets and live streams.

The final disparate live media output stream may contain one or more decision points, which, if configured, may be presented by the consumer device to the user. In this regard, the final disparate live media output stream may be delivered as a live stream between the decision points whether or not the programming content selected by a user is pre-encoded media asset or a live input stream. At the one or more decision points, the user interaction may correspond to one of a desired selection corresponding to the user interaction with one or more interactive elements, or a default selection corresponding to non-interaction of a user with the customized first programming content and/or the targeted first non-programming content in the first disparate live media output stream played back by the media player. The desired selection or the default selection may be transmitted to an external storage system that is the repository of schedules, rights, and user preferences database **144**.

In accordance with an embodiment, at the one or more decision points, the one or more interactive elements may facilitate exclusion of the targeted first non-programming content or the customized first programming content and replacement by default content. The one or more interactive elements may further facilitate selection of alternate customized first programming content, selection of a subsequent second programming content, approval or disapproval

of the selected customized first programming content, and/or exclusion of subsequent second non-programming content for a remaining portion of the first disparate live media output stream played back by the media player. The one or more interactive elements may further facilitate selection of one or more targeted first non-programming content of a specific category, or viewing of some or all of the targeted first non-programming content immediately to avoid some or all of the targeted first non-programming content for the remaining portion of the first disparate live media output stream played back by the media player.

In accordance with another aspect of the disclosure, the DACIS **103**, upon the first manifest request, may seamlessly transition the first additional content to an alternate additional content according to determination made by the stream selection service **142**, based on one or more transition parameters. The one or more transition parameters may comprise one or more parameters from the first manifest request, current state of the first disparate live media output stream manifest determined based on accessibility, regular update, and suitable encoding, digital rights management, and compatibility with the first client device, rules provided by a stream owner operator, and user preferences defined in the repository of schedules, rights, and user preferences database **144**.

The DACIS **103** may retrieve alternate metadata for the alternate additional content from the CPDS **107**. The alternate metadata may indicate a location to seamlessly transition from the first additional content to the alternate additional content, and may include ad break locations, graphical treatment markers/triggers, SCTE35 markers/triggers, content duration, and/or one or more decision points. The DACIS **103** may be configured to determine placement of the alternate additional content within the first disparate live media output stream manifest based on the associated indexed metadata and the alternate metadata. The DACIS **103** may generate an alternate programming schedule for the first client device based on the alternate additional content and the alternate metadata. The DACIS **103** may transmit the generated alternate programming schedule to the stream publishing engine **114**. The stream publishing engine **114** may generate a final disparate live output stream manifest for the consumer device.

In accordance with an embodiment, the DACIS **103** may revoke the first disparate live media output stream manifest published for the first consumer device based on an identifier primitive associated with the first disparate live media output stream of the first consumer device in an instance in which a media player of the first consumer device is determined to be a plagiarized media player with unauthorized access to content. In such embodiment, the first disparate live media output stream may include at least one unique identifier inserted by the DACIS **103**.

In accordance with another aspect of the disclosure, a system is provided for managing a pre-encoded media asset for immediate playback. The SSAI system **109** may be configured to generate, based on a receipt of an initial manifest request from a first client device, an initial pre-encoded media asset manifest that comprises an initial set of programming content segments. The SSAI system **109** may be further configured to communicate the generated initial pre-encoded media asset manifest, as a first disparate live media output stream manifest, to a media player of the first client device via a content delivery system for an immediate playback of a pre-encoded media asset. The SSAI system **109** may be further configured to assign a unique SID to the first client device to record a session of the first client device for a subsequent manifest request or a final manifest request associated with the initial manifest request. The SSAI system **109** may be further configured to generate a final pre-encoded media asset manifest upon a receipt of the subsequent manifest request from the first client device based on a defined criterion. The final pre-encoded media asset manifest may comprise remaining programming content segments corresponding to the pre-encoded media asset, non-scheduled programming content segments corresponding to each non-scheduled programming content, and non-programming content segments corresponding to each non-programming content based on targeting and/or non-targeting parameters.

FIG. **1**B is a block diagram that illustrates an exemplary DACIS for publishing an updated disparate live media output stream in mixed mode based on user selection, in accordance with an exemplary embodiment of the disclosure. Referring to FIG. **1**B, the DACIS **103** comprises a first programming schedule **111**, an alternate programming schedule **113**, a stream publishing engine **114**, a personalized experience manager (PEM) **115**, and an indexing and storage system **116**. FIG. **1**B further illustrates a content delivery system **130**, which is an example of the network **108**, client devices **132***a*, . . . , **132***n*, which correspond to the plurality of consumer devices **110***a*, . . . , **110***n*. There is further shown a per-client disparate live media output stream **117***a*, . . . , **117***n* for corresponding client device from the client devices **132***a*, . . . , **132***n*.

In some embodiments of the disclosure, the stream publishing engine **114**, the PEM **115**, and the indexing and storage system **116** may be integrated to form an integrated system, as illustrated in FIG. **1**B. In some embodiments of the disclosure, as shown, the stream publishing engine **114**, the PEM **115**, and the indexing and storage system **116** may be distinct. In this regard, the PEM **115** may be implemented external to the DACIS **103** without loss of generality. Other separation and/or combination of the various entities of the exemplary media packaging and distribution system **102** illustrated in FIG. **1**B may be done without departing from the spirit and scope of the various embodiments of the disclosure. In an embodiment, the implementation of the DACIS **103** may be on the server-side. In another embodiment, the implementation of the DACIS **103** may be on the client-side.

The first programming schedule **111** may correspond to an instruction set for a disparate live media output stream for a corresponding client device. The first programming schedule **111** may inform the stream publishing engine **114** about pre-encoded media assets and live input streams as well as when and how to switch between the various pre-encoded media assets and live input streams. The first programming schedule **111** may also support defining break durations for mid roll ads, break locations, and durations in the pre-encoded media asset and live input stream switches.

The alternate programming schedule **113** may correspond to an instruction set for an updated or alternate disparate live media output stream. The alternate programming schedule **113** may inform the stream publishing engine **114** about the alternate pre-encoded media asset and/or the alternate live input stream, and alternate additional content. Specifically, the alternate programming schedule **113** may indicate that when and how to switch between the various disparate live media output streams.

The stream publishing engine **114** in the DACIS **103** may be configured to generate disparate live media output stream manifests and variants of disparate live media output stream manifests. The stream publishing engine **114** may be con-

figured to publish unique-to-client streaming manifests leveraging different indexes created by the indexing and storage system **116** from the various live input streams, pre-encoded media assets, targeted non-programming content and customized programming content based on a defined per-client schedule.

The PEM **115** in the DACIS **103** may be configured to personalize viewer experience of users by communicating with existing content decisioning systems, such as CDS **105**, and executing/converting schedules provided, for example from the first programming schedule **111** to the alternate programming schedule **113**. The PEM **115** in the DACIS **103** may be further configured to communicate with an ad server, such as the Ad decisioning server **106***a*, and stitching in targeted first non-programming content and customized first programming content, as required by the first programming schedule **111** and user preferences. The PEM **115** in the DACIS **103** may be further configured to generate a schedule for a disparate live media output stream of personalized content (i.e., clips or movies), communicating with the stream selection service **142** to switch or failover to different disparate live media input streams, and control overlays and other events triggered via the disparate live media output stream. In accordance with an embodiment, the stream selection service **142** may be used to switch between different output streams when a client device is requesting directly from the stream selection service **142**. In accordance with other embodiment, the stream selection service **142** may be used to switch between different streams that may act as inputs for the PEM **115** and/or stream publishing engine **114** to generate a new output stream.

The indexing and storage system **116** in the DACIS **103** may be configured to ingest pre-encoded media assets, advertisement, and (continuously) live stream source manifests, indexes the media content segments, indexes one or more program indicators (such as program boundaries), non-programming indicators (such as ad break locations, overlay opportunities credits, and DRM systems supported, in the repository of schedules, rights, and user preferences database **144**.

The per-client disparate live media output streams **117***a*, . . . , **117***n* may correspond to disparate live media output stream comprising live input streams and/or pre-encoded media assets to be sent back to a client device, upon request, that has been generated from a per-client schedule, such as the first programming schedule **111**. Various media container formats of the live input streams and/or pre-encoded media assets may include, but are not limited to, transport stream (TS), fragmented MP4 (fMP4), Common Media Application Format (CMAF) and the like.

The content delivery system **130** may correspond to the network **108**, described in FIG. **1**. The content delivery system **130** may comprise networks configured for distributing media content to the plurality of client devices **132***a*, . . . , **132***n*. Generally, the term "content," "metadata," "media," and similar words are used interchangeably to refer to any type of media—audio, videos, datacasts, music, text, images, graphics, articles, still photos, animated photos, moving photos, photo galleries, video galleries, infographics, maps, polls, guest biographies, tweets or other social media, blog posts, and/or the like. The content delivery system **130** may be configured to provide a plurality of disparate live media output streams to the plurality of client devices **132***a*, . . . , **132***n* (in case packaged content is available on the network **108**) or from the content packaging and distribution system **107** (in case packaged content is not available on the network **108**). The plurality of disparate live media output streams may be provided to the plurality of client devices **132***a*, . . . , **132***n* via, for example, a transport stream, a segmented streaming, a progressive download, or any other modes of distributing a multimedia presentation, such as via an over-the-air content delivery/distribution network, a linear content delivery/distribution network, a cable content delivery/distribution network, a satellite content delivery/distribution network, an Internet Protocol (IP) based content delivery/distribution network, and/or the like.

The client devices **132***a*, . . . , **132***n* may correspond to consumer devices **110***a*, . . . , **110***n*. In accordance with an embodiment, the client devices **132***a*, . . . , **132***n* may be content recognition (CR)-enabled devices, such as automatic content recognition enabled devices. The client devices **132***a*, . . . , **132***n* may be configured to communicate with the Ad decisioning server **106***a*, via the content delivery system **130**, or a separate communication network.

The stream selection service **142** may comprise suitable logic, circuitry, and interfaces that may be configured to provide a client device, for example, the client device **132***a*, requesting to view a disparate live media output stream with a correct variant of disparate live media output stream, based on the geolocation and identification of the client device **132***a*, along with data retrieved from the repository of schedules, rights, and user preferences database **144**. The stream selection service **142** may further receive user preferences of a user associated with the client device **132***a*, for example, to view the recommended/desired existing disparate live media output stream on the client device **132***a*. The stream selection service **142** may further store the received preferences in the repository of schedules, rights, and user preferences database **144**, and also communicate with the PEM **115**. The stream selection service **142** acts as an interface between the PEM **115** of the media packaging and distribution system **102** and the plurality of client devices **132***a*, . . . , **132***n*.

The repository of schedules, rights, and user preferences database **144** may comprise suitable logic, circuitry, and interfaces that may be configured to execute code to store content rights, user preferences, regional preferences, live schedules, and regional rights. For example, content rights may store availability and platform rights for live input streams in the first programming schedules, such as the first programming schedule **111**, the user preferences may store preferences of individual user viewing preferences, the regional preferences may store regional viewing preferences, the live schedules may store the schedules for live input streams, and the regional rights may store regional blackout zones for the various sports leagues, for example. The repository of schedules, rights, and user preferences database **144** may further store data supplied from a stream owner/operator including requirements, preferences, such as pre-defined location-based viewing preferences, stream transition rules, and any required client data, such as service level and zip code.

In operation, in accordance with an aspect (regarding just-in-time insertion of non-programming content and/or programming content) of the disclosure, a media player in a consumer device, such as the consumer device **110***a*, may send a first manifest request to the DACIS **103** to receive a disparate live media output stream manifest to begin or continue playback. The first manifest request may comprise one or more parameters, such as universal resource locators and/or identifiers referencing records for one or more live input streams or one or more pre-encoded media assets in the CPDS **107**, a plurality of client-specific parameters, and a plurality of client-specified attributes derived from a user

interaction with the consumer device, such as the consumer device **110***a*. The plurality of client-specific parameters may comprise user preferences and identifiers, client device preferences and identifiers, and one or more rules governed by geolocation data and current position of playback of a first disparate live media output stream at the consumer device, such as the consumer device **110***a*. The plurality of client-specified attributes may comprise the user interaction with interactive content in a customized first programming content and a targeted first non-programming content, and a preference for a type and/or category of the targeted first non-programming content and/or the customized first programming content. The user interaction with the interactive content may comprises a selection to exclude the targeted first non-programming content and/or the customized first programming content, a selection to include a subset of the targeted first non-programming content and/or the customized first programming content, and a selection to include all of the targeted first non-programming content and/or the customized first programming content within one or more specified non-programming content locations.

In case the first manifest request is for a first disparate live media output stream, the PEM **115** transmits the one or more parameters in the first manifest request to the stream selection service **142**. The stream selection service **142** may determine live input streams and/or pre-encoded media assets, based on the one or more parameters in the first manifest request and in repository of schedules, rights, and user preferences database **144**. The stream selection service **142** may transmit the determined identifiers or URLs of the live input streams and/or pre-encoded media assets to the PEM **115**. The PEM **115** may then transmit the first manifest request to the CPDS **107** to retrieve metadata for the determined live input streams and/or pre-encoded media assets. The metadata may include, for example ad break locations, overlay markers/triggers, SCTE35 markers, and content duration.

The PEM **115** of the DACIS **103** may further transmit the received first manifest request to the CPDS **107** based on the selected one or more live input streams and/or one or more pre-encoded media assets. The PEM **115** may receive the indexed metadata, for example non-programming indicators, such as ad break locations, graphical treatment indicators, such as overlay markers/triggers, programming indictors, such as SCTE35 markers and content duration, from the CPDS **107**.

The PEM **115** may further identify the one or more content placement opportunities defined by the metadata associated with the one or more live input streams and/or one or more pre-encoded media assets. The PEM **115** may further receive additional content, such as targeted first non-programming content from the Ad decisioning server **106***a*, and customized first programming content to match one or more personalization parameters from the CDS **105**.

The PEM **115** may be configured to generate the first programming schedule **111** for a first client device, such as the client device **132***a*, based on selected one or more live input streams and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content. The generated first programming schedule **111** may be delivered to the stream publishing engine **114**. The stream publishing engine **114** may be configured to select the one or more live input stream manifests and/or the one or more pre-encoded media asset manifests published in the content delivery system **130**. The indexing and storage system **116** may be configured to index the plurality of media segments indicated by the one or more pre-encoded media asset manifests and the one or more live input stream manifests, the associated indexed metadata, the targeted first non-programming content, and the customized first programming content may be indexed based on the first programming schedule **111** generated for the first client device, for example the client device **132***a*. The stream publishing engine **114** may be further configured to publish the first disparate live media output stream manifest for the first client device, for example the client device **132***a*. The DACIS **103** may transmit the published first disparate live media output stream manifest to the media player of the first client device for playback of the first disparate live media output stream, for example the disparate live media output stream **117***a*.

In accordance with an embodiment, the PEM **115** may receive a user interaction from the media player of the first client device, for example the client device **132***a*. The user interaction may correspond to one of a desired selection corresponding to the user interaction with one or more interactive elements, or a default selection corresponding to a non-interaction of the user with the customized first programming content and/or the targeted first non-programming content in the first disparate live media output stream **117***a* played back by the media player. Based on the user interaction with the interactive content, the PEM **115** of the DACIS **103** may be configured to modify the remaining portion of the first programming schedule **111** that generates the first disparate live media output stream **117***a* corresponding to the first manifest request generated by the first client device, such as the client device **132***a*.

In accordance with another aspect (regarding personalized insertion of playlist of non-programming content and/or programming content) of the disclosure, the DACIS **103** may be configured to receive the first manifest request from the first client device, such as a client device **132***a*, to begin or continue playback of a first disparate live media output stream, for example the disparate live media output stream **117***a*. In such embodiment, in addition to the plurality of client-specific parameters described above, the plurality of client-specified attributes may comprise a preference for a given type and/or category (or categories) of targeted non-programming content or customized programming content, and a possible time constraint (duration) to fill with content. Thereafter, in similar manner as described above, the PEM **115** may transmit the one or more parameters in the first manifest request to the stream selection service **142**. The stream selection service **142** may determine live input streams and/or pre-encoded media assets, based on the one or more parameters in the first manifest request and in repository of schedules, rights, and user preferences database **144**. The stream selection service **142** may transmit the determined identifiers or URLs of the live input streams and/or pre-encoded media assets to the PEM **115**. The PEM **115** may then transmit the first manifest request to the CPDS **107** to retrieve metadata for the determined live input streams and/or pre-encoded media assets. The metadata may include, for example, categories to which content is assigned to (for example, "basketball", "sports", "Knicks"), in addition to ad break locations, overlay markers/triggers, SCTE35 markers, and content duration.

The PEM **115** may identify one or more content placement opportunities defined by the metadata and may transmit a request to the CDS **105** to determine the customized first programming content from the CPDS **107** for matching one or more personalization parameters. Accordingly, the PEM **115** may generate the first programming schedule **111** defining locations and types of one or more decision points

defined by the one or more content placement opportunities in the indexed metadata. The one or more decision points may define personalized content preferences, skipping of personalized content and moving to default content, and approval or disapproval of the personalized content. The remaining operations may be similar to the just-in-time insertion of non-programming content and/or programming content.

In accordance with another aspect (regarding stream failover) of the disclosure, the DACIS **103** may be configured to receive the first manifest request from the first client device, such as a client device **132***a*. The first manifest request may comprise one or more parameters, as described above. The PEM **115** may transmit the received first manifest request that comprises the one or more parameters to the stream selection service **142**. The stream selection service **142** may determine if the set of criteria associated with the first disparate live media output stream is satisfied. The set of criteria may include accessibility of the first disparate live media output stream, update of the first disparate live media output stream and/or compatibility of the first disparate live media output stream having media and/or a manifest with the first manifest request. The stream selection service **142** may be further configured to determine the one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters in the first manifest request, and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**. The stream selection service **142** may be further configured to determine the one or more live input streams and/or one or more pre-encoded media assets based on rules provided by a stream owner/operator (such as a regional blackout for the first client device leading to an alternative stream to watch) and user preferences (that exclude certain categories) defined in the repository of schedules, rights, and user preferences database **144**.

When the set of criteria associated with the first disparate live media output stream is not satisfied, the stream selection service **142** may select a pre-encoded asset indicated in the first manifest request to continue playback as the first disparate live media output stream. The PEM **115** may receive the universal resource locators and/or identifiers that reference records for the selected one or more live input streams or alternate one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**. The PEM **115** may further transmit the received first manifest request to the CPDS **107** based on the selected one or more live input streams or alternate one or more pre-encoded media assets. The PEM **115** may further receive the alternate metadata for the alternate additional content from the CPDS **107**. The metadata may include, for example, Ad break locations, overlay markers/triggers, SCTE35 markers/triggers, content duration, and one or more decision points. The alternate metadata may further include a location to transition from the first additional content to the alternate additional content. Thereafter, a placement of alternate additional content within the first disparate live media output stream manifest may be determined based on the associated indexed metadata and the alternate metadata. The PEM **15** may further generate the alternate programming schedule for the first client device, such as the client device **132***a*, based on the alternate additional content and alternate metadata. Accordingly, the stream selection service **142** may publish the final disparate live output stream manifest for the first client device, such as the client device **132***a*, based on the generated alternate programming schedule.

FIG. **1**D is a block diagram that illustrates an exemplary system for managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure. Referring to FIG. **1**D, the system **100**D comprises the SSAI system **109** that further comprises an internal manifest index **109***a*. The SSAI system **109** may be communicatively coupled to the CDS **105**, the Ad decisioning servers **106***a*, . . . , **106***n*, the CPDS **107**, the external data source **120**, the content delivery system **130** (which is an example of the network **108**), the client devices **132***a*, . . . , **132***n*, a memory **134**, and the repository of schedules, rights, and user preferences database **144**. The CPDS **107** may further comprise a content encoder/packager **107***a* and a content metadata store **107***b*.

Some of the components of the system **100**D, such as the CDS **105**, the Ad decisioning servers **106***a*, . . . , **106***n*, the CPDS **107**, the SSAI system **109**, the external data source **120**, the content delivery system **130**, the client devices **132***a*, . . . , **132***n*, and the repository of schedules, rights, and user preferences database **144** have already been described in detail in FIGS. **1**A and **1**B.

Multiple processors, such as the SSAI system **109** and the content encoder/packager **107***a*, may comprise suitable logic, circuitry, interfaces, and/or code operable to process and execute a set of instructions stored in the memory **134**. In some embodiments, multiple processors and/or multiple buses may be used, as appropriate, along with multiple memories and types of memory. Also, multiple processors, each providing portions of the necessary operations (for example, as a server cluster, a group of servers, or a multi-processor system), may be inter-connected and integrated. The processors may be implemented based on a number of processor technologies known in the art. Examples of the processors may be an X86-based processor, a Reduced Instruction Set Computing (RISC) processor, an Application-Specific Integrated Circuit (ASIC) processor, a Complex Instruction Set Computing (CISC) processor, and/or other processors.

The content encoder/packager **107***a* may comprise suitable logic, circuitry, and interfaces that may be configured to execute code to determine a package that includes media content, such as pre-encoded media assets, and associated metadata. Thus, the content encoder/packager **107***a* encodes and packages the media content into required on-demand formats for delivery to the client devices **132***a*, . . . , **132***n*. The media content may correspond to one or more of the programming content segments of the pre-encoded media assets transcoded to different types of streams for different types of devices, such as a TV or a mobile device, and marked with Nielson markers. Based on such a package, one or more encoded media assets may be dynamically generated for playout to one or more media players communicatively coupled through the content delivery system **130**.

The content encoder/packager **107***a* may be configured to publish the one or more encoded media assets, as one or more pre-encoded media assets, in real-time or near real-time to the content delivery system **130**. The content encoder/packager **107***a* may also be configured to provide near-real time redundancy. In accordance with an embodiment, the resulting converted output, i.e., one or more encoded media assets, that are generated by the content encoder/packager **107***a* may be communicated to the indexing and storage system **116** which may be communicatively coupled with the plurality of consumer devices **108***a*, . . . ,

108*n*. The content encoder/packager **107***a* may also support a robust interface (for example, application data interface (ADI)) that defines the on-demand duration of the individual segments as well as encryption requirements and a service type to link for advertisement insertion.

The content metadata store **107***b* may comprise suitable logic, circuitry, and interfaces that may be configured to store metadata associated with pre-encoded media assets. Examples of the metadata may include pre-encoded media asset identifiers, titles of the pre-encoded media asset, type of the pre-encoded media assets (such as movie series (season episode number)), genre, plot summary, duration, advertisement break locations, credit locations, scene descriptions, a short summary of the programming content segments, a short summary of ideal advertisement placements within the pre-encoded media asset manifests, a file format, digital right management (DRM), encryption information, length of the pre-encoded media assets, a date and/or time the pre-encoded media assets were added to a catalog of media content, a new item indicator for the pre-encoded media assets (for example, a new media asset that became available within the last 24 hours, last few days, last week, and/or the like), pre-encoded media asset classes, for example, a television show, a cartoon program, a movie, a news media, an episode, a game, a clip, a recorded sports event, interactive media, and/or the like. In accordance with an exemplary embodiment, the content metadata store **107***b* may also store program-specific information (PSI) data as defined by ISO/IEC 13818-1 (MPEG-2), closed captioning data, and subtitles associated with the programming media segments. Other forms of metadata may be utilized without departing from the spirit and scope of the various embodiments of the disclosure.

In accordance with various embodiments, the metadata in the content metadata store **107***b* may define a first set of content placement opportunities where non-scheduled programming content and/or non-programming content are inserted in a pre-encoded media asset manifest. The non-scheduled programming content may correspond to additional content provided by the CDS **105**. Examples of the non-scheduled programming content may include media content that are not advertisements, such as gamebooks. The non-programming content may correspond to advertisement breaks or promotional content provided by an advertisement decision server, such as the Ad decisioning server **106***a*. The first set of content placement opportunities may correspond to programming indicators associated with the non-scheduled programming content and non-programming indicators associated with the non-programming content.

The metadata may further define a second set of content placement opportunities where event-based programming content, such as opening credits, closing credits, timing, and previous episode recaps, occurs in the pre-encoded media asset manifest. The event-based programming content may correspond to an identifier corresponding to an event related to the content of the pre-encoded media asset. The second set of content placement opportunities may correspond to event markers.

In accordance with an embodiment, the metadata in the content metadata store **107***b* may store timestamps of the first set of content placement opportunities and the second set of content placement opportunities upon the generation of the pre-encoded media asset.

The internal manifest index **109***a* in the SSAI system **109** may comprise suitable logic, circuitry, and interfaces that may be configured to store programming segments of pre-encoded media asset manifests corresponding to the pre-encoded media assets. The internal manifest index **109***a* may be a time-series database in which manifests are ingested. Such pre-encoded media asset manifests may be accessed from the internal manifest index **109***a* by the SSAI system **109** based on the received initial manifest request.

The memory **134** may comprise suitable logic, circuitry, and/or interfaces that may be operable to store a machine code and/or a computer program with at least one code section executable by the processors, such as the SSAI system **109** and the content encoder/packager **107***a*. The memory **134** may be configured to store information within the system **100**D. In some embodiments, the memory **134** may include one or more volatile memory units. In other embodiments, the memory **134** may be a non-volatile memory unit or units. In yet other embodiments, the memory **134** may be another form of computer-readable medium, such as a magnetic or optical disk. Examples of forms of implementation of the memory **134** may include, but are not limited to, a Random Access Memory (RAM), a Read Only Memory (ROM), a Hard Disk Drive (HDD), and/or a Secure Digital (SD) card.

In operation, the content encoder/packager **107***a* may generate a pre-encoded media asset comprising a plurality of programming content segments for distribution and adjust the plurality of programming content segments in the pre-encoded media asset based on the metadata retrieved from the content metadata store **107***b*. The content encoder/packager **107***a* may store the timestamps of the first set of content placement opportunities and the second set of content placement opportunities in the metadata upon the generation of the pre-encoded media asset. Also, the content encoder/packager **107***a* may mark the start location and the end location of each of the first set of content placement opportunities and the second set of content placement opportunities in the pre-encoded media asset manifest. The content encoder/packager **107***a* may store the pre-encoded media asset manifest in the content delivery system **130** or the internal manifest index **109***a*.

In accordance with an embodiment, the SSAI system **109** may receive an initial manifest request from a first client device, such as the client device **132***a*, to view a pre-encoded media asset. The SSAI system **109** may access the pre-encoded media asset manifest, based on received initial manifest request, from the content delivery system **130** or the internal manifest index **109***a*. The SSAI system **109** may receive an instruction, based on the targeting and/or non-targeting parameters, the external system, and/or the set of pre-determined rules. In accordance with a first instruction, the SSAI system **109** may insert each non-scheduled programming content and/or non-programming content in the pre-encoded media asset manifest as an initial and final response to the initial manifest request for the playback of the pre-encoded media asset at the first client device, such as the client device **132***a* in accordance with the first instruction based on the targeting and/or non-targeting parameters, the external system, and/or the set of pre-determined rules. In accordance with an embodiment, the initial pre-encoded media asset manifest may enable the immediate playback of the pre-encoded media asset at the first client device in accordance with a second instruction.

The SSAI system **109** may further determine the capability of the first client device, such as the client device **132***a*, based on the targeting and/or non-targeting parameters, the external system and/or the set of pre-determined rules. The capability of the first client device may correspond to an extent of player integration with the SSAI system **109** and compatibility of the first client device with a required

protocol. In accordance with an embodiment, the extent of the player integration with the system is limited and the first client device is incompatible with the required protocol. The SSAI system **109** may generate, based on the receipt of an initial manifest request from the first client device (such as the client device **132***a*), the initial pre-encoded media asset manifest that comprises the initial set of programming content segments. The size of the initial set of programming content segments is verified to be equal to capacity of the playback buffer in the media player of the first client device. In accordance with another embodiment, the extent of the player integration with the system is complete and the first client device is compatible with the required protocol. The SSAI system **109** may generate, based on the receipt of the initial manifest request from the first client device (such as the client device **132***a*), the initial pre-encoded media asset manifest. The initial pre-encoded media asset manifest may comprise the initial set of programming content segments up to the first content placement opportunity marked for insertion of the non-scheduled programming content and/or the non-programming content.

Accordingly, the SSAI system **109** may communicate the generated initial pre-encoded media asset manifest, as the first disparate live media output stream manifest, to the media player of the first client device (such as the client device **132***a*) via the content delivery system **130** for an immediate playback of the pre-encoded media asset. In accordance with another embodiment, the initial pre-encoded media asset manifest may be independent of the non-scheduled programming content and/or the non-programming content. The initial pre-encoded media asset manifest may be based on the targeting and/or non-targeting parameters, an external system, and/or a set of pre-determined rules. The initial pre-encoded media asset manifest may enable the immediate playback of the pre-encoded media asset at the first client device in accordance with the second instruction.

The SSAI system **109** may further designate the initial pre-encoded media asset manifest to inform the media player of the first client device (such as the client device **132***a*) to generate the subsequent manifest request as if it were a live or an event stream. Further, a unique SID may be assigned to the first client device (such as the client device **132***a*) to record a session of the first client device for the subsequent manifest request or the final manifest request associated with the initial manifest request.

In accordance with an embodiment, the SSAI system **109** may verify the receipt of the information regarding each of the non-scheduled programming content and/or the non-programming content from corresponding servers. Further, the SSAI system **109** may determine whether the insertion of each of the non-scheduled programming content and/or the non-programming content is complete or incomplete in the updated pre-encoded media asset manifest based on the received information.

In accordance with an embodiment, the SSAI system **109** may generate the final pre-encoded media asset manifest upon the receipt of the subsequent manifest request from the first client device, such as the client device **132***a*, based on the defined criterion. The defined criterion may correspond to the determination that the insertion of the non-scheduled programming content and/or the non-programming content in the final pre-encoded media asset manifest is complete. The SSAI system **109** may communicate the final pre-encoded media asset manifest to the first client device, such as the client device **132***a*, in response to the subsequent manifest request when the defined criterion is met. The final pre-encoded media asset manifest may be designated to inform the media player of the first client device, such as the client device **132***a*, to cease further generation of the subsequent manifest request. At this instant, the SSAI system **109** may store the initial, the updated, and/or the final pre-encoded media asset manifests as a set of asset manifests corresponding to the unique SID for the designated period of time.

The SSAI system **109** may further determine whether the pre-encoded media asset manifest and/or the metadata include the second set of content placement opportunities. In accordance with an embodiment, the SSAI system **109** may add the additional content segments corresponding to the pre-encoded media asset, the non-scheduled programming content segments and/or the non-programming content segments in the updated pre-encoded media asset manifest to provide additional time duration. The SSAI system **109** may complete the insertion of the non-scheduled programming content and/or the non-programming content in the updated pre-encoded media asset manifest at a portion of or an entire first set of content placement opportunities defined in the metadata.

In accordance with another embodiment, the SSAI system **109** may add the plurality of event-based programming content segments and the additional content segments in the updated pre-encoded media asset manifest when the pre-encoded media asset manifest and/or the metadata includes the second set of content placement opportunities where event-based programming content occurs in the pre-encoded media asset manifest. The size of the additional content segments matches with capacity of a playback buffer in the media player of the first client device, such as the client device **132***a*. The SSAI system **109** may allow the media player of the first client device, such as the client device **132***a*, to begin the immediate playback after the marked end location of the plurality of event-based programming content segments upon a receipt of an input from the first client device, such as the client device **132***a*, to skip the event-based programming content.

In accordance with an embodiment, the SSAI system **109** may communicate an updated pre-encoded media asset manifest to the first client device, such as the client device **132***a*, in response to the updated manifest request. The SSAI system **109** may designate the updated pre-encoded media asset manifest to inform the media player of the first client device, such as the client device **132***a*, to generate the subsequent manifest request or the final manifest request. Such cycle is repeated until the final pre-encoded media asset manifest with the non-scheduled programming content and/or the non-programming content can be generated that meets the defined criterion. Once generated, the final pre-encoded media asset manifest may be communicated to the first client device, such as the client device **132***a*. As described above, the final pre-encoded media asset manifest may be designated to inform the media player of the first client device, such as the client device **132***a*, to cease further generation of the subsequent manifest request. At this instant, the SSAI system **109** may store the initial, the updated, and/or the final pre-encoded media asset manifests as a set of asset manifests corresponding to the unique SID for the designated period of time.

FIG. **2** illustrates segmentation of live input streams and pre-encoded media assets for the first programming schedule **111** or the alternate programming schedule **113** for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content by the DACIS **103** of FIG.

1B, in accordance with an exemplary embodiment of the disclosure. Referring to the exemplary arrangement of FIG. **2**, there is shown a first live input stream **202**, a first pre-encoded media asset **204**, and a second live input stream **206**. There is also shown a targeted first non-programming content **208** placed after the first live input stream **202**, and a customized first programming content **210** placed after the first pre-encoded media asset **204**. The first live input stream **202** may be segmented into a first set of video segments **202***a*, **202***b*, **202***c*, . . . , **202***n*. Similarly, the first pre-encoded media asset **204** and the second live input stream **206** may also be segmented into second set of video segments **204***a*, **204***b*, **204***c*, . . . , **204***n*, and third set of video segments **206***a*, **206***b*, **206***c*, . . . , **206***n* respectively. By way of example, the segmentation may be executed by a segmenting system (for example a live stream encoder/packager and/or a content encoder/packager (not shown)) during a preparation stage of the media assets. The encode stage may create various quality levels and the package stage segments the content into the short segments, and produces the correct format, such as TS, fMP4, or CMAF and encrypts the media content to prevent piracy. In accordance with an embodiment, the segments of the first set of video segments **202***a*, **202***b*, **202***c*, . . . , **202***n*, the second set of video segments **204***a*, **204***b*, **204***c*, . . . , **204***n*, and third set of video segments **206***a*, **206***b*, **206***c*, . . . , **206***n*, may be segmented into consistent length, for example, 10 seconds segments. It may be advantageous to have a consistent and smaller file size of segments to be able to quickly push to the content delivery system **130**, and also for quick downloading by a media player at the end-user side, such as on the plurality of consumer devices **110***a*, . . . , **110***n*.

It should be understood by those skilled in the art that various changes may be made and segments of different file sizes (or length) may be used without departure from the scope of the present disclosure. Further, other streaming protocols may require a different processing of media content. Thus, the scope of the disclosure should not be limited to the processing or preparation of media content to allow delivery using different delivery methods, streaming protocols, or distribution system, known in the art. Further, instead of the live input streams and pre-encoded media asset arranged, as shown, different arrangements per the first programming schedule **111** or the alternate programming schedule **113** may be possible with respect to interstitial content items, such as the targeted first non-programming content **208** and the customized first programming content **210**.

The insertion of the live input stream manifests, pre-encoded media asset manifests, the targeted first non-programming content **208** and the customized first programming content **210** may be done on-the-fly based on dynamic scheduling by the PEM **115** that generates the first programming schedule **111** or the alternate programming schedule **113**. The insertion may be driven by real time or near-real time content context analysis, user-selection on the consumer devices **110***a*, . . . , **110***n*, or driven by external data received from the external data source **120**. The PEM **115** in association with the stream selection service **142** may be configured to insert live input streams, such as the first live input stream **202** and the second live input stream **206**, or pre-stored media assets, such as the first pre-encoded media asset **204**, the targeted first non-programming content **208** and the customized first programming content **210**, in an existing disparate live media output stream based on manipulation of a manifest the existing disparate live media output stream, such as an existing channel.

In accordance with an embodiment, each segment of the first set of video segments **202***a*, **202***b*, **202***c*, . . . , **202***n*, the second set of video segments **204***a*, **204***b*, **204***c*, . . . , **204***n*, and third set of video segments **206***a*, **206***b*, **206***c*, . . . , **206***n*, may be further processed to be stored at various quality levels, and content encryption modes for the purposes of adaptive bitrate streaming and digital rights management, for example, the video segment **202***a* may be stored in a plurality of quality levels, for example, high definition (HD), high dynamic range (HDR) video, or different quality levels in accordance with specified pixel resolutions, bitrates, frame rates, and/or sample frequencies. As each of the media content, such as **202** to **206**, are encoded, segmented, and stored with the plurality of quality levels in a media content master storage system. The media content may be re-used to create new channels, such as a new disparate live media output stream, without having to re-encode a selected live input stream or a pre-encoded media asset when a new disparate live media output stream is created using the live input streams or a pre-encoded media asset.

For the sake of brevity, and with reference to FIG. **2**, there is shown an example of publishing the first or the updated (or alternate) disparate live media output streams based on dynamic insertion of targeted non-programming content and customized programming content by the DACIS **103** of FIG. **1**B. It is to be understood that media packaging for different delivery methods (such as analog terrestrial broadcast, digital terrestrial broadcast, direct-to-home satellite broadcast, cable, other Internet Protocol (IP)-based delivery methods, over-the-top television (OTT)), different streaming protocols, or distribution system, may be different. The media content may be prepared to be viewed one or more of the plurality of consumer devices **110***a*, . . . , **110***n*, based on at least the desired delivery method, delivery conditions, content protection requirements, to satisfy operational and technical requirements, as needed. The operational and technical requirements may include, but are not limited to, media encoding, media segmentation, programming schedule (or manifest) creation or manipulation requirements, desired media encryption, and/or metadata signaling requirements. For example, in certain scenarios and for certain media content delivery methods, network bandwidth, network conditions, or device-type where media content is to be consumed may not be variable or known in advance. In such a case, creating different quality levels for same media content may not be required. Further, based on different operational and technical requirements, publishing of disparate live media output stream may be different. The media content that is prepared and distributed may include both the programming content, such as long-form presentations, short-form presentations, news or sporting events; and non-programming content, such as paid advertisements, public service advertisements, or promotional material.

FIG. **3** illustrates an exemplary scenario associated with publishing a disparate live media output stream by the DACIS **103** of FIG. **1**B, in accordance with an exemplary embodiment of the disclosure. Referring to the exemplary scenario **300**, there are illustrated two disparate live media output streams **302** and **304** published for two users associated with the client devices **132***a* and **132***n*, respectively. The disparate live media output stream **302** may be existing disparate live media output stream for the client device **132***a*. The disparate live media output stream **304** may be a disparate per-client live media output stream published based on dynamic insertion of targeted non-programming content and customized programming content by the DACIS **103** of FIG. **1**B for the client device **132***n*.

The live NBA game may be scheduled to start at 8:00 pm. However, a user associated with the client device **132***n* tunes in early to watch the NBA game, for example at 7:15 pm. However, the user may not be interested in watching the end of the current programming media content. In such a case, the PEM **115** in the DACIS **103** may determine targeted non-programming content, such as sports items ads, and customized programming content, such as NBA highlights of previous game and generates the alternate programming schedule **113**. Accordingly, the stream publishing engine **114** in the DACIS **103** may publish an alternate disparate live media output stream **117***n* for the client device **132***n*. At 8:00 pm, the DACIS **103** may switch back to the live NBA game scheduled at 8:00 pm.

FIGS. **4**A to **4**D depict flowcharts illustrating exemplary operations for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content in the media packaging and distribution system **102** of FIG. **1**B, in accordance with an exemplary embodiment of the disclosure. Specifically, flowcharts **400**A and **400**B collectively depicts a method for just-in-time insertion of non-programming content and/or programming content, in accordance with an embodiment of the disclosure. Flowchart **400**C depicts a method for personalized insertion of non-programming content and/or programming content, in accordance with an embodiment of the disclosure. Flowchart **400**E depicts a method for stream failover, in accordance with an embodiment of the disclosure.

Referring to FIGS. **4**A and **4**B, flowcharts **400**A and **400**B collectively depicts a method for just-in-time insertion of non-programming content and/or programming content, in accordance with an embodiment of the disclosure.

At **402**A, a first manifest request may be received from a first client device. In accordance with an embodiment, the DACIS **103** may be configured to receive the first manifest request from the first client device, such as a client device **132***a*, to begin or continue playback of a first disparate live media output stream, for example the disparate live media output stream **117***a*. The first manifest request may comprise one or more parameters. Examples of the one or more parameters may include, but are not limited to, universal resource locators and/or identifiers referencing records for existing one or more live input streams or one or more pre-encoded media assets in the CPDS **107**, a plurality of client-specific parameters, and a plurality of client-specified attributes derived from a user interaction with the first client device, such as the client device **132***a*. Examples of the plurality of client-specific parameters may include, but are not limited to, user preferences and identifiers, client device preferences and identifiers, and one or more rules governed by geolocation data and current position of playback of a first disparate live media output stream, such as the disparate live media output stream **117***a*, at the first client device, such as the client device **132***a*. In an embodiment, the client-specified attributes derived from a user interaction with the first client device may include, but are not limited to, the user interaction with interactive content in a customized first programming content and a targeted first non-programming content, and a preference for a type and/or category of the targeted first non-programming content and/or the customized first programming content. The user interaction with the interactive content may comprise, for example, a selection to exclude the targeted first non-programming content and/or the customized first programming content, a selection to include a subset of the targeted first non-programming content and/or the customized first programming content, and a selection to include all of the targeted first non-programming content and/or the customized first programming content within one or more specified non-programming content locations.

At **404**A, the received first manifest request that comprises one or more parameters may be transmitted to the stream selection service **142**. In an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the received first manifest request that comprises the one or more parameters to the stream selection service **142**.

In an embodiment, based on the received first manifest request, the stream selection service **142** may be configured to select one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**. Accordingly, the stream selection service **142** may be configured to return universal resource locators and/or identifiers that reference records for the selected one or more live input streams and/or one or more pre-encoded media assets to the PEM **115**.

At **406**A, the universal resource locators and/or identifiers that reference records for the selected one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144** may be received. In an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the universal resource locators and/or identifiers that reference records for the selected one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**.

At **408**A, the received first manifest request may be transmitted to the CPDS **107** based on the selected one or more live input streams and/or one or more pre-encoded media assets. In an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the received first manifest request to the CPDS **107** based on the selected one or more live input streams and/or one or more pre-encoded media assets.

In an embodiment, based on the received first manifest request, the CPDS **107** may be configured to retrieve indexed metadata, for example, non-programming indicators, such as ad break locations, graphical treatment indicators, such as overlay markers/triggers, programming indictors, such as SCTE35 markers and content duration. Accordingly, the CPDS **107** may be configured to return the indexed metadata to the PEM **115**.

At **410**A, the indexed metadata may be received from the CPDS **107**. In an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the indexed metadata from the CPDS **107**. Examples of the indexed metadata may include, but are not limited to, non-programming indicators, such as ad break locations, graphical treatment indicators, such as overlay markers/triggers, programming indictors, such as SCTE35 markers and content duration, as described above.

At **412**A, one or more content placement opportunities defined by the metadata associated with the one or more live input streams and/or one or more pre-encoded media assets may be identified. In an embodiment, the PEM **115** of the DACIS **103** may be configured to identify the one or more content placement opportunities defined by the metadata associated with the one or more live input streams and/or one or more pre-encoded media assets. Examples of the one

or more content placement opportunities may include, but are not limited to, non-programming indicators, such as ad break locations, graphical treatment indicators, such as overlay markers/triggers, programming indictors, such as SCTE35 markers and personalized content opportunity. In an embodiment, for the identified one or more content placement opportunities, the PEM **115** of the DACIS **103** may be configured to determine additional content, such as non-programming content (such as advertisements), personalized programming content (such as promotional content), graphical treatment (such as overlays), and one or more decision point locations.

At **414**, a request may be transmitted to the Ad decisioning server **106***a* to determine targeted first non-programming content. In an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the request to the Ad decisioning server **106***a* to determine the targeted first non-programming content.

In an embodiment, based on the request, the Ad decisioning server **106***a* may be configured to identify the targeted first non-programming content, such as an advertising or an graphical treatment content, to be scheduled in one or more content placement opportunities, based on the one or more parameters. In an embodiment, the Ad decisioning server **106***a* may be configured to identify the targeted first non-programming content based on execution of a non-programming content service based on rules and conditions defined in additional parameters of the repository of schedules, rights, and user preferences database **144**, and the one or more parameters defined in the first manifest request. Accordingly, the Ad decisioning server **106***a* may be configured to transmit the identified targeted first non-programming content to the PEM **115** of the DACIS **103**.

At **416**, the targeted first non-programming content may be received from the Ad decisioning server **106***a*. In an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the targeted first non-programming content from the Ad decisioning server **106***a*.

At **418**, a request may be transmitted to the CDS **105** to determine a customized first programming content to match one or more personalization parameters. In an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the request to the CDS **105**. The CDS **105** may determine a customized first programming content to match one or more personalization parameters.

In an embodiment, based on the request, the CDS **105** may be configured to identify the customized first programming content based on the one or more parameters in the first manifest request, and the rules and conditions defined in the additional parameters of the repository of schedules, rights, and user preferences database **144**. Accordingly, the CDS **105** may be configured to transmit the identified customized first programming content to the PEM **115** of the DACIS **103**.

At **420**, the customized first programming content may be received from the CDS **105**. In an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the customized first programming content from the CDS **105**.

At **422**, a first additional content comprising the customized first programming content and the targeted first non-programming content may be determined for the first client device based on the one or more parameters and the associated indexed metadata. In an embodiment, the PEM **115** of the DACIS **103** may be configured to determine the first additional content comprising the customized first programming content, received from the CDS **105**, and the targeted first non-programming content, received from the Ad decisioning server **106***a*. The first additional content may be determined for the first client device, such as the client device **132***a*, based on the one or more parameters and the associated indexed metadata, received from the CPDS **107**.

At **424**, a first programming schedule **111** may be generated for the first client device based on the selected one or more live input streams and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content. In an embodiment, the PEM **115** of the DACIS **103** may be configured to generate the first programming schedule **111** for the first client device, such as the client device **132***a*, based on selected one or more live input streams and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content.

In accordance with an embodiment, the generated first programming schedule **111** may not include the first additional content, in accordance with the one or more parameters in the first manifest request. In accordance with another embodiment, the generated first programming schedule **111** may include the first additional content, in accordance with the one or more parameters in the first manifest request. In accordance with another embodiment, the generated first programming schedule **111** may include a subset of the first additional content, in accordance with the one or more parameters in the first manifest request.

In accordance with an embodiment, the first additional content scheduled to be inserted, may be inserted into, for example, one or more pre-encoded assets in accordance with appropriate markers. The appropriate markers may be defined in the metadata of the one or more pre-encoded assets, and rules and conditions defined in the repository of schedule, rights, and user preferences database **144**.

In accordance with an embodiment, the generated first programming schedule **111** may define locations and types of one or more decision points defined by the one or more content placement opportunities in the indexed metadata. The one or more decision points may be included in the first programming schedule **111**. Within the first programming schedule **111**, the one or more decision points may define various types of the decision points, for example, an Ad preference, skip next ad, skip future ads, watch ads immediately instead of at future ad locations, or personalized content preferences.

In an exemplary embodiment, the one or more pre-encoded media assets are scheduled and the one or more decision points, defined by the one or more content placement opportunities, are inserted in the first programming schedule **111**. In such exemplary embodiment, the first programming schedule **111** may be configured to control the one or more pre-encoded media asset manifests to be published as, for example, the first disparate live media output stream manifest. Further, the first programming schedule **111** may include, for example, segments, markers, the one or more content placement opportunities, up to and including next available decision point.

At **426**, the first programming schedule **111** may be delivered to the stream publishing engine **114**. In accordance with an embodiment, the PEM **115** in the DACIS **103** may be configured to deliver the first programming schedule **111** to the stream publishing engine **114**.

At **428**, one or more live input stream manifests and/or one or more pre-encoded media asset manifests published in the content delivery system **130** may be selected. In accordance with an embodiment, the stream publishing engine **114** in the DACIS **103** may be configured to select the one

or more live input stream manifests and/or the one or more pre-encoded media asset manifests published in the content delivery system **130**.

At **430**, a plurality of media segments indicated by the one or more pre-encoded media asset manifests and the one or more live input stream manifests, the associated indexed metadata, the targeted first non-programming content, and the customized first programming content may be indexed based on the first programming schedule **111** generated for the first client device. In accordance with an embodiment, the indexing and storage system **116** may be configured to index the plurality of media segments indicated by the one or more pre-encoded media asset manifests and the one or more live input stream manifests, the associated indexed metadata, the targeted first non-programming content, and the customized first programming content may be indexed based on the first programming schedule **111** generated for the first client device, for example the client device **132***a*.

At **432**, a first disparate live media output stream manifest for the first client device may be published based on insertion of the selected one or more live input stream manifests and/or the one or more pre-encoded media asset manifests, the associated indexed metadata, and the determined first additional content, into the first disparate live media output stream manifest, in accordance with the first programming schedule **111** generated for the first client device. In accordance with an embodiment, the stream publishing engine **114** in the DACIS **103** may be configured to publish the first disparate live media output stream manifest for the first client device, for example the client device **132***a*. The publication may be based on insertion of the selected one or more live input stream manifests and/or the one or more pre-encoded media asset manifests, the associated indexed metadata, and the determined first additional content, into the first disparate live media output stream manifest, in accordance with the first programming schedule **111** generated for the first client device, for example the client device **132***a*.

At **434**, the published first disparate live media output stream manifest may be transmitted to a media player of the first client device for playback of the first disparate live media output stream, for example the disparate live media output stream **117***a*. In accordance with an embodiment, the DACIS **103** may be configured to transmit the published first disparate live media output stream manifest to the media player of the first client device for playback of the first disparate live media output stream, for example the disparate live media output stream **117***a*. In accordance with an embodiment, the first disparate live media output stream manifest for the first client device, for example the client device **132***a*, may be generated based on one of a pre-defined conversion modes. The pre-defined conversion modes may correspond to conversion of pre-encoded media assets to live stream mode, pre-encoded media assets to live stream mode with scalable architecture, a live stream to live stream mode, and a mixed mode corresponding to switches between pre-encoded media assets and live streams.

In accordance with an embodiment, the published first disparate live media output stream manifest may be delivered to the first client device, for example the client device **132***a*. Accordingly, the media player of the first client device, for example the client device **132***a*, may begin or continue playback of the first disparate live media output stream **117***a*. Further, the media player, during playback of the first disparate live media output stream **117***a* at the first client device, for example the client device **132***a*, presents one or more decision points defined by the interactive content to initiate a user interaction at the first client device, for example the client device **132***a*.

In accordance with an embodiment, during the playback, in case a decision point exists, is enabled, and presented by the first client device, for example the client device **132***a*, the user of the client device **132***a* may interact with one or more interactive elements at the decision point and influence (or modify) remaining first disparate live media output stream **117***a*.

For example, in an embodiment of just-in-time non-programming content insertion, at the one or more decision points, the user interaction corresponds to one of a desired selection corresponding to the user interaction with one or more interactive elements, or a default selection corresponding to non-interaction of a user with the customized first programming content and/or the targeted first non-programming content in the first disparate live media output stream **117***a* played back by the media player. In another example, in an embodiment of personalized content playlist, at the one or more decision points, the user interaction corresponds to one of exclusion of the targeted first non-programming content or the customized first programming content and replacement by default content, selection of alternate customized first programming content, selection of a subsequent second programming content, approval or disapproval of the selected customized first programming content, exclusion of subsequent second non-programming content for a remaining portion of the first disparate live media output stream **117***a* played back by the media player, selection of one or more targeted first non-programming content of a specific category, or viewing of some or all of the targeted first non-programming content immediately to avoid some or all of the targeted first non-programming content for the remaining portion of the first disparate live media output stream played back by the media player.

At **436**, the user interaction may be received that corresponds to one of a desired selection corresponding to the user interaction with one or more interactive elements, or a default selection corresponding to a non-interaction of the user with the customized first programming content and/or the targeted first non-programming content in the first disparate live media output stream **117***a* played back by the media player. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the user interaction may be received. The user interaction may correspond to one of a desired selection corresponding to the user interaction with one or more interactive elements, or a default selection corresponding to a non-interaction of the user with the customized first programming content and/or the targeted first non-programming content in the first disparate live media output stream **117***a* played back by the media player.

At **438**, a remaining portion of the first programming schedule **111** that generates the first disparate live media output stream **117***a* corresponding to the first manifest request generated by the first client device, such as the client device **132***a*, may be modified based on the user interaction with the interactive content. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to modify the remaining portion of the first programming schedule **111** that generates the first disparate live media output stream **117***a* corresponding to the first manifest request generated by the first client device, such as the client device **132***a*, based on the user interaction with the interactive content.

At **440**, a desired selection or the default selection may be transmitted to an external storage system that is the reposi-

tory of schedules, rights, and user preferences database **144**. In accordance with an embodiment, the first client device, for example the client device **132***a*, may be configured to transmit the desired selection or the default selection to the external storage system that is the repository of schedules, rights, and user preferences database **144**.

In accordance with an embodiment, the user interaction or non-interaction result may be sent to future client manifest requests to influence the remainder of the first disparate live media output stream **117***a*. This may allow for a user choice, such as to skip an ad, to result with another manifest request to the DACIS **103** to update the existing first disparate live media output stream **117***a* with the intended behavior and affect playback of the first disparate live media output stream **117***a* within the first client device.

Referring to FIG. **4**C, flowchart **400**C depicts a method for personalized insertion of playlist of non-programming content and/or programming content, in accordance with an embodiment of the disclosure.

At **402**B, a first manifest request may be received from a first client device. In accordance with an embodiment, the DACIS **103** may be configured to receive the first manifest request from the first client device, such as a client device **132***a*, to begin or continue playback of a first disparate live media output stream, for example the disparate live media output stream **117***a*. The first manifest request may comprise one or more parameters. Examples of the one or more parameters may include, but are not limited to, universal resource locators and/or identifiers referencing records for existing one or more live input streams or one or more pre-encoded media assets in the CPDS **107**, a plurality of client-specific parameters, and a plurality of client-specified attributes derived from a user interaction with the first client device, such as the client device **132***a*. Examples of the plurality of client-specific parameters may include, but are not limited to, user preferences and identifiers, client device preferences and identifiers, and one or more rules governed by geolocation data and current position of playback of a first disparate live media output stream, such as the disparate live media output stream **117***a*, at the first client device, such as the client device **132***a*. In another embodiment, the client-specified attributes derived from a user interaction with the first client device may include, but are not limited to, a preference for a type and/or category of the targeted first non-programming content and/or the customized first programming content, and a possible time constraint (or duration) to fill with the targeted first non-programming content and/or the customized first programming content. The user interaction with the interactive content may comprise, for example, a selection to exclude the targeted first non-programming content and/or the customized first programming content, a selection to include a subset of the targeted first non-programming content and/or the customized first programming content, and a selection to include all of the targeted first non-programming content and/or the customized first programming content within one or more specified non-programming content locations.

The user interaction with the interactive content may comprise, for example, a selection to exclude the targeted first non-programming content and/or the customized first programming content, a selection to include a subset of the targeted first non-programming content and/or the customized first programming content, and a selection to include all of the targeted first non-programming content and/or the customized first programming content within one or more specified non-programming content locations.

At **404**B, the received first manifest request that comprises one or more parameters may be transmitted to the stream selection service **142**. In an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the received first manifest request that comprises the one or more parameters to the stream selection service **142**.

In an embodiment, based on the received first manifest request, the stream selection service **142** may be configured to select one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**. Accordingly, the stream selection service **142** may be configured to return universal resource locators and/or identifiers that reference records for the selected one or more live input streams and/or one or more pre-encoded media assets to the PEM **115**.

At **406**B, the universal resource locators and/or identifiers that reference records for the selected one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144** may be received. In an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the universal resource locators and/or identifiers that reference records for the selected one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**.

At **408**B, the received first manifest request may be transmitted to the CPDS **107** based on the selected one or more live input streams and/or one or more pre-encoded media assets. In an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the received first manifest request to the CPDS **107** based on the selected one or more live input streams and/or one or more pre-encoded media assets.

In an embodiment, based on the received request, the CPDS **107** may be configured to retrieve indexed metadata, for example, non-programming indicators, such as ad break locations, graphical treatment indicators, such as overlay markers/triggers, programming indictors, such as SCTE35 markers, content duration, and categories (such as, "basketball", "sports", "Knicks") to which the programming content has been assigned.

At **410**B, the indexed metadata may be received from the CPDS **107**. In an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the indexed metadata from the CPDS **107**. Examples of the indexed metadata may include, but are not limited to, non-programming indicators, such as ad break locations, graphical treatment indicators, such as overlay markers/triggers, programming indictors, such as SCTE35 markers and content duration, as described above.

At **412**B, one or more content placement opportunities defined by the metadata associated with the one or more live input streams and/or one or more pre-encoded media assets may be identified. In an embodiment, the PEM **115** of the DACIS **103** may be configured to identify the one or more content placement opportunities defined by the metadata associated with the one or more live input streams and/or one or more pre-encoded media assets. Examples of the one or more content placement opportunities may include, but are not limited to, non-programming indicators, such as ad break locations, graphical treatment indicators, such as overlay markers/triggers, programming indictors, such as

SCTE35 markers and personalized content opportunity. In an embodiment, for the identified one or more content placement opportunities, the PEM **115** of the DACIS **103** may be configured to determine additional content, such as non-programming content (such as advertisements), personalized programming content (such as promotional content), graphical treatment (such as overlays), and one or more decision point locations.

At **442**, a request may be transmitted to the CDS **105** to determine a customized first programming content from the CPDS **107** for matching one or more personalization parameters. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit a request to the CDS **105** to determine the customized first programming content from the CPDS **107** for matching one or more personalization parameters. Examples of the one or more personalization parameters may include, but are not limited to, user preferences and identifiers from the first manifest request or retrieved from the repository of schedules, rights, and user preferences database **144**, and time constraints. The time constraints may be determined based on user preferences retrieved from the repository of schedules, rights, and user preferences database **144**, a range defined in the first manifest request, and schedule tolerances defined in the repository of schedules, rights, and user preferences database **144**, client device preferences or identifiers from the first manifest request or retrieved from the repository of schedules, rights, and user preferences database **144**, geolocation information from the first manifest request or retrieved from the repository of schedules, rights, and user preferences database **144**, and/or a content recommendation engine.

At **444**, the first programming schedule **111** may be generated for the first client device based on the selected one or more live input streams and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to generate the first programming schedule **111** for the first client device, such as the client device **132***a*, based on the selected one or more live input streams and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content.

In accordance with an embodiment, the first additional content scheduled to be inserted, may be inserted into, for example, one or more pre-encoded assets in accordance with appropriate markers. The appropriate markers may be defined in the metadata of the one or more pre-encoded assets, and rules and conditions defined in the repository of schedule, rights, and user preferences database **144**.

In accordance with an embodiment, the generated first programming schedule **111** may define locations and types of one or more decision points defined by the one or more content placement opportunities in the indexed metadata. Such one or more decision points may be included in the first programming schedule **111**. Within the first programming schedule **111**, the one or more decision points may define personalized content preferences, skipping of personalized content and moving to default content, and approval or disapproval of the personalized content.

In an exemplary embodiment, the one or more pre-encoded media assets are scheduled and the one or more decision points, defined by the one or more content placement opportunities, are inserted in the first programming schedule **111**. In such exemplary embodiment, the first programming schedule **111** may be configured to control the one or more pre-encoded media asset manifests to be published as, for example, the first disparate live media output stream manifest. Further, the first programming schedule **111** may include, for example, segments, markers, the one or more content placement opportunities, up to and including next available decision point. Thereafter, control passes to **426** in flowchart **400**B and exemplary operations till **440** may be performed in similar manner as described above.

Referring to FIG. **4**D, there is illustrated a flowchart **400**D depicting a method for stream failover, in accordance with an embodiment of the disclosure.

At **402**C, a first manifest request may be received from a first client device. In accordance with an embodiment, the DACIS **103** may be configured to receive the first manifest request from the first client device, such as a client device **132***a*, to begin or continue playback of a first disparate live media output stream, for example the disparate live media output stream **117***a*. The first manifest request may comprise one or more parameters. Examples of the one or more parameters may include, but are not limited to, universal resource locators of existing one or more live input streams, identifiers referencing records for existing one or more live input streams or one or more pre-encoded media assets in the CPDS **107**, and a plurality of client-specific parameters. Examples of the plurality of client-specific parameters may include, but are not limited to, user preferences and identifiers, client device preferences and identifiers, and one or more rules governed by geolocation data and current position of playback of a first disparate live media output stream, such as the disparate live media output stream **117***a*, at the first client device, such as the client device **132***a*.

At **404**C, received first manifest request that comprises one or more parameters may be transmitted to the stream selection service **142**. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the received first manifest request that comprises the one or more parameters to the stream selection service **142**.

At **454**, it may be determined that a set of criteria associated with the first disparate live media output stream is satisfied. In accordance with an embodiment, the stream selection service **142** may be configured to determine if the set of criteria associated with the first disparate live media output stream is satisfied. The set of criteria may include an accessibility of the first disparate live media output stream, update of the first disparate live media output stream and/or compatibility of the first disparate live media output stream having media and/or a manifest with the first manifest request. The stream selection service **142** may be further configured to determine the one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters in the first manifest request, and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**. The stream selection service **142** may be further configured to determine the one or more live input streams and/or one or more pre-encoded media assets based on rules provided by a stream owner/operator (such as a regional blackout for the first client device leading to an alternative stream to watch) and user preferences (that exclude certain categories) defined in the repository of schedules, rights, and user preferences database **144**.

In accordance with an embodiment, when the first disparate live media output stream is not accessible, the first disparate live media output stream is not updated and/or the first disparate live media output stream having media and/or

manifest that is not compatible with the first manifest request. Further, in an absence of one or more live input streams, the stream selection service **142** may be configured to select a pre-encoded asset indicated in the first manifest request to continue playback as the first disparate live media output stream. In such embodiment, control passes to operation **456**. Otherwise, control passes to operation **406**A of the flowchart **400**A.

At **456**, universal resource locators and/or identifiers that reference records for the selected one or more live input streams or alternate one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144** may be received. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the universal resource locators and/or identifiers that reference records for the selected one or more live input streams or alternate one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**.

At **458**, a received first manifest request may be transmitted to the CPDS **107** based on the selected one or more live input streams or alternate one or more pre-encoded media assets. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to transmit the received first manifest request to the CPDS **107** based on the selected one or more live input streams or alternate one or more pre-encoded media assets.

At **460**, alternate metadata for alternate additional content may be received from the CPDS **107**. In accordance with an embodiment, the PEM **115** of the DACIS **103** may be configured to receive the alternate metadata for the alternate additional content from the CPDS **107**. The metadata may include, for example, Ad break locations, overlay markers/triggers, SCTE35 markers/triggers, content duration, and one or more decision points. The alternate metadata may further include a location to transition from the first additional content to the alternate additional content.

At **462**, a placement of alternate additional content within the first disparate live media output stream manifest may be determined based on the associated indexed metadata and the alternate metadata. In accordance with an embodiment, the PEM **15** of the DACIS **103** may be configured to determine the placement of the alternate additional content within the first disparate live media output stream manifest based on the associated indexed metadata and the alternate metadata.

At **464**, an alternate programming schedule may be generated for the first client device based on the alternate additional content and alternate metadata. In accordance with an embodiment, the PEM **15** of the DACIS **103** may be configured to generate the alternate programming schedule for the first client device, such as the client device **132***a*, based on the alternate additional content and alternate metadata.

At **466**, a final disparate live output stream manifest may be published for the first client device based on the generated alternate programming schedule. In accordance with an embodiment, the PEM **15** of the DACIS **103** may be configured to publish the final disparate live output stream manifest for the first client device, such as the client device **132***a*, based on the generated alternate programming schedule.

In accordance with an embodiment, the final disparate live output stream manifest for the first client device may be generated based on one of the pre-defined conversion modes. The pre-defined conversion modes may correspond to pre-encoded media assets to live stream mode, pre-encoded media assets to live stream mode with scalable architecture, a live stream to live stream mode, and a mixed mode corresponding to switches between pre-encoded media assets and live streams.

In accordance with an embodiment, during playout, the first additional content may be transitioned to the alternate additional content based on one or more transition parameters. The one or more transition parameters may comprise one or more parameters from the first manifest request, current state of the first disparate live media output stream manifest determined based on accessibility, regular update, and suitable encoding, digital rights management, and compatibility with the first client device, rules provided by a stream owner operator, and user preferences defined in the repository of schedules, rights, and user preferences database **144**.

As described above in FIGS. **4**A and **4**B, the published final disparate live output stream manifest may be transmitted to the media player of the first client device for playback of the final disparate live media output stream. Accordingly, the first client device begins or continues the playback of the final disparate live media output stream.

In an alternate embodiment, at **454**, the stream selection service **142** may be configured to select a second disparate live media output stream according to accessibility of the first disparate live media output stream in case the set of criteria associated with the first disparate live media output stream is not satisfied. The stream selection service **142** may be configured to select the second disparate live media output stream according to rules provided by a stream owner/operator and user preferences defined in the repository of schedules, rights, and user preferences database **144**. The operations that follow may be performed in a similar manner, as the operations for the first disparate live media output stream are performed.

FIG. **5**A is a conceptual diagram illustrating an example of a hardware implementation for a media packaging and distribution system **102** employing a processing system for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, in accordance with an exemplary embodiment of the disclosure. Referring to FIG. **5**, the hardware implementation shown by a representation **500** for the media packaging and distribution system **102** employs a processing system **502** for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, in accordance with an exemplary embodiment of the disclosure, as described herein. In some examples, the processing system **502** may comprise one or more hardware processors **504**, a non-transitory computer-readable medium **506**, a bus **508**, a bus interface **510**, and a transceiver **512**. FIG. **5**A further illustrates the DACIS **103**, the CDS **105**, the CPDS **107**, the stream publishing engine **114**, PEM **115**, indexing and storage system **116**, the stream selection service **142**, and the repository of schedules, rights, and user preferences database **144**, as described in detail in FIGS. **1**A and **1**B.

The hardware processor **504** may be configured to manage the bus **508** and general processing, including the execution of a set of instructions stored on the non-transitory computer-readable medium **506**. The set of instructions, when executed by the processor **504**, causes the media packaging and distribution system **102** to execute the various functions described herein for any particular apparatus.

The hardware processor **504** may be implemented, based on a number of processor technologies known in the art. Examples of the hardware processor **504** may be a Reduced Instruction Set Computing (RISC) processor, an Application-Specific Integrated Circuit (ASIC) processor, a Complex Instruction Set Computing (CISC) processor, and/or other processors or control circuits.

The non-transitory computer-readable medium **506** may be used for storing data that is manipulated by the processor **504** when executing the set of instructions. The data is stored for short periods or in the presence of power. The non-transitory computer-readable medium **506** may also be configured to store data for one or more of the DACIS **103**, the CDS **105**, the CPDS **107**, the stream publishing engine **114**, PEM **115**, indexing and storage system **116**, the stream selection service **142**, and the repository of schedules, rights, and user preferences database **144**.

The bus **508** is configured to link together various circuits. In this example, the media packaging and distribution system **102** employing the processing system **502** and the non-transitory computer-readable medium **506** may be implemented with bus architecture, represented generally by bus **508**. The bus **508** may include any number of interconnecting buses and bridges depending on the specific implementation of the media packaging and distribution system **102** and the overall design constraints. The bus interface **510** may be configured to provide an interface between the bus **508** and other circuits, such as, transceiver **512**, and external devices, such as source device **118**, external data source **120**, and client devices **132***a*, . . . , **132***n*.

The transceiver **512** may be configured to provide a communication of the media packaging and distribution system **102** with various other apparatus, such as the Ad decisioning servers **106***a*, . . . , **106***n*, the consumer devices **110***a*, . . . , **110***n*, such as the client devices **132***a*, . . . , **132***n*, the external data source **120**, and the source device **118**, via the network **108**. The transceiver **512** may communicate via wireless communication with networks, such as the Internet, the Intranet and/or a wireless network, such as a cellular telephone network, a wireless local area network (WLAN) and/or a metropolitan area network (MAN). The wireless communication may use any of a plurality of communication standards, protocols and technologies, such as Global System for Mobile Communications (GSM), Enhanced Data GSM Environment (EDGE), Long Term Evolution (LTE), wideband code division multiple access (W-CDMA), code division multiple access (CDMA), time division multiple access (TDMA), Bluetooth, Wireless Fidelity (Wi-Fi) (such as IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), voice over Internet Protocol (VoIP), and/or Wi-MAX.

It should be recognized that, in some embodiments of the disclosure, one or more components of FIG. **5**A may include software whose corresponding code may be executed by at least one processor, for across multiple processing environments. For example, the DACIS **103**, the CDS **105**, the CPDS **107**, the stream publishing engine **114**, PEM **115**, indexing and storage system **116**, the stream selection service **142**, and the repository of schedules, rights, and user preferences database **144** may include software that may be executed across a single or multiple processing environments.

In an aspect of the disclosure, the processor **504**, the non-transitory computer-readable medium **506**, or a combination of both may be configured or otherwise specially programmed to execute the operations or functionality of the DACIS **103**, the CDS **105**, the CPDS **107**, the stream publishing engine **114**, PEM **115**, indexing and storage system **116**, the stream selection service **142**, and the repository of schedules, rights, and user preferences database **144**, or various other components described herein, as described with respect to FIGS. **1**A to **4**D.

FIG. **5**B is a conceptual diagram illustrating an example of a hardware implementation for a media packaging and distribution system **102** employing a processing system for managing a pre-encoded media asset for immediate playback, in accordance with exemplary embodiments of the disclosure. Referring to FIG. **5**B, the hardware implementation shown by a representation **500**A for the media packaging and distribution system **102** employs a processing system **552** for managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure, as described herein. In some examples, the processing system **552** may comprise one or more hardware processors, such as a processor **554**, a non-transitory computer-readable medium **556**, a bus **558**, a bus interface **560**, and a transceiver **562**.

In accordance with an embodiment, for managing a pre-encoded media asset for immediate playback, FIG. **5**B further illustrates the CDS **105**, the CPDS **107**, the SSAI system **109**, and the repository of schedules, rights, and user preferences database **144**. The SSAI system **109** may further comprise the internal manifest index **109***a*, and the CPDS **107** may further comprise the content encoder/packager **107***a* and the content metadata store **107***b*. In accordance with an embodiment, as illustrated in FIG. **5**B, the SSAI system **109** may be implemented within the DACIS **103**, as described above in FIG. **1**A. However, in accordance with another embodiment, not illustrated in FIG. **5**B, the SSAI system **109** may be implemented separately from the DACIS **103**, as described above in FIG. **1**C. As the SSAI system **109** is implemented for pre-encoded media assets, the functionalities of a few components, such as the stream publishing engine **114**, the PEM **115**, and the stream selection service **142**, utilized in conjunction with the DACIS **103** in the media packaging and distribution system **102**, may not be required.

The processor **554** may be configured to manage the bus **558** and general processing, including the execution of a set of instructions stored on the non-transitory computer-readable medium **556**. The set of instructions, when executed by the processor **554**, causes the media packaging and distribution system **102** to execute the various functions described herein for any particular apparatus. The processor **554** may be implemented, based on several processor technologies known in the art. Examples of the processor **554** may be a Reduced Instruction Set Computing (RISC) processor, an Application-Specific Integrated Circuit (ASIC) processor, a Complex Instruction Set Computing (CISC) processor, and/or other processors or control circuits.

The non-transitory computer-readable medium **556** may be used for storing data that is manipulated by the processor **554** when executing the set of instructions. The data is stored for short periods or in the presence of power. The non-transitory computer-readable medium **556** may also be configured to store data for one or more of the DACIS **103**, the CDS **105**, the CPDS **107**, the SSAI system **109**, the memory **134**, and the repository of schedules, rights, and user preferences database **144**.

The bus **558** is configured to link together various circuits. In this example, the media packaging and distribution system **102** employing the processing system **552** and the non-transitory computer-readable medium **556** may be implemented with bus architecture, represented generally by

bus **558**. The bus **558** may include any number of interconnecting buses and bridges depending on the specific implementation of the media packaging and distribution system **102** and the overall design constraints. The bus interface **560** may be configured to provide an interface between the bus **558** and other circuits, such as, transceiver **562**, and external devices, such as the Ad decisioning servers **106***a*, . . . , **106***n*, the external data source **120**, the content delivery system **130**, and the client devices **132***a*, . . . , **132***n*.

In accordance with an embodiment, the transceiver **562** may be configured to provide a communication of the media packaging and distribution system **102** with various other apparatus, such as the Ad decisioning servers **106***a*, . . . , **106***n*, the external data source **120**, the content delivery system **130**, and the client devices **132***a*, . . . , **132***n*, via the network **108**. The transceiver **562** may communicate via wireless communication with networks, such as the Internet, the Intranet and/or a wireless network, such as a cellular telephone network, a wireless local area network (WLAN) and/or a metropolitan area network (MAN). The wireless communication may use any of a plurality of communication standards, protocols and technologies, such as Global System for Mobile Communications (GSM), Enhanced Data GSM Environment (EDGE), Long Term Evolution (LTE), wideband code division multiple access (W-CDMA), code division multiple access (CDMA), time division multiple access (TDMA), Bluetooth, Wireless Fidelity (Wi-Fi) (such as IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), voice over Internet Protocol (VoIP), and/or Wi-MAX.

It should be recognized that, in some embodiments of the disclosure, one or more components of FIG. **5**B may include software whose corresponding code may be executed by at least one processor, for across multiple processing environments. For example, the DACIS **103**, the CDS **105**, the CPDS **107**, the SSAI system **109**, the memory **134**, and the repository of schedules, rights, and user preferences database **144** may include software that may be executed across a single or multiple processing environments.

In an aspect of the disclosure, the processor **554**, the non-transitory computer-readable medium **556**, or a combination of both may be configured or otherwise specially programmed to execute the operations or functionality of the DACIS **103**, the CDS **105**, the CPDS **107**, the SSAI system **109**, the memory **134**, and the repository of schedules, rights, and user preferences database **144**, or various other components described herein, as described with respect to FIGS. **1**A, **1**C, **1**D, **6**A to **6**C, and **7**A to **7**E.

FIG. **6**A illustrates a first exemplary scenario associated with managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure. Referring to FIG. **6**A, there is illustrated a first exemplary scenario **600**A that corresponds to a fast start delivery model for segmented web video. In accordance with the first exemplary scenario **600**A, there is illustrated a first pre-encoded media asset **602** generated for the first client device, such as the client device **132***a*. There is shown a plurality of indexed programming content segments, such as PS **1**, . . . , PS Last, and two sets of segments of non-programming content, for example advertisements, in the first pre-encoded media asset **602**. A first ad break is at a location L**1** between the programming content segments PS **50** and PS **51**, and a second ad break is at a location L**2** between the programming content segments PS **110** and PS **111** in the first pre-encoded media asset **602**.

In accordance with a first use case **604**, the client device **132***a* may be an old client with limited player integration with the SSAI system **109**. Further, the client device **132***a* may be incompatible with the required protocol version of modern streaming protocols, such as HLS and DASH, implemented for the SSAI system **109**. In such a use case, to ensure smooth and immediate video playback of the first pre-encoded media asset **602** at the client device **132***a*, the SSAI system **109** may communicate an initial pre-encoded media asset manifest, such as Manifest **1**, comprising an initial set of programming content segments, such as PS **1**, . . . , PS **3**, to the client device **132***a*. The size of the initial set of programming content segments, i.e., three programming content segments, is verified to be equal to the capacity of the playback buffer (typically 3) in the media player of the client device **132***a*. The client device **132***a* may download and buffer the initial set of programming content segments, i.e., PS **1**, . . . , PS **3**, before the playback. While the client device **132***a* is downloading the initial set of programming content segments and begins an immediate playback, the SSAI system **109** may insert the non-programming content, such as advertisements, in the pre-encoded media asset manifest. Meanwhile, the client device **132***a* may generate a subsequent manifest request for an updated pre-encoded media asset manifest, such as Manifest **2**, after a specified time duration controlled by the player-system integration. In response to the subsequent manifest request, as the insertion of the advertisements is not yet completed, the SSAI system **109** may add additional content segments, such as PS **4** and PS **5**, to the initial pre-encoded media asset manifest, such as Manifest **1**, and generate an updated pre-encoded media asset manifest, such as Manifest **2**. The SSAI system **109** may communicate the updated pre-encoded media asset manifest, such as Manifest **2**, comprising updated set of programing content segments, such as PS **1**, . . . , PS **5**, to the client device **132***a*. The client device **132***a* continues the playback and again generates a subsequent manifest request for an updated pre-encoded media asset manifest, such as Manifest **3**, after a specified time duration controlled by the player-system integration.

In response to the subsequent manifest request, as the insertion of the advertisements is completed, the SSAI system **109** may add remaining programming content segments, such as PS **6**, . . . , PS Last. The SSAI system **109** may further stitch the set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, of a first advertisement at the location L**1** between the programming content segments PS **50** and PS **51**, and a set of non-programming content segments, such as NPS **4**, . . . , NPS **6**, of a second advertisement at a location L**2** between the programming content segments PS **110** and PS **111** and generate the final pre-encoded media asset manifest, such as Manifest **3**. Accordingly, the SSAI system **109** may communicate the final pre-encoded media asset manifest, such as Manifest **3**, to the client device **132***a*. Further, the final pre-encoded media asset manifest, such as Manifest **3**, is designated to inform the media player of the client device **132***a* to cease further generation of the subsequent manifest request.

In accordance with a second use case **606**, the client device **132***a* may be a new client with complete player integration with the SSAI system **109**. Further, the client device **132***a* may be compatible with the required protocol version of modern streaming protocols, such as HLS and DASH. In such a use case, to ensure smooth and immediate video playback of the first pre-encoded media asset **602** at the client device **132***a*, the SSAI system **109** may communicate an initial pre-encoded media asset manifest, such as Manifest **1**, comprising an initial set of programming con-

tent segments, such as PS **1**, . . . , PS **50**, up to a first ad break location, such as location L**1**, marked for insertion of the first advertisement.

The client device **132***a* may download and buffer the initial set of programming content segments, i.e., PS **1**, . . . , PS **50**, before the playback. While the client device **132***a* is downloading the initial set of programming content segments and begins an immediate playback from the beginning of the playback buffer, the SSAI system **109** may insert the non-programming content, such as the first advertisement at the location L**1** and the second advertisement at the location L**2**, in the pre-encoded media asset manifest. The client device **132***a* may generate a subsequent manifest request for an updated pre-encoded media asset manifest, such as Manifest **2**, after a specified time duration controlled by the player-system integration. In response to the subsequent manifest request, as the insertion of the advertisements is completed, the SSAI system **109** may add remaining programming content segments, such as PS **51**, . . . , PS Last. The SSAI system **109** may further stitch a set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, of the first advertisement at the location L**1** between the programming content segments PS **50** and PS **51**, and another set of non-programming content segments, such as NPS **4**, . . . , NPS **6**, of the second advertisement at the location L**2** between the programming content segments PS **110** and PS **111** in the final pre-encoded media asset manifest, such as Manifest **2**, as the defined criterion of completion of advertisement insertion is met. Accordingly, the SSAI system **109** may communicate the final pre-encoded media asset manifest, such as Manifest **2**, to the client device **132***a*. Further, the final pre-encoded media asset manifest, such as Manifest **2**, is designated to inform the media player of the client device **132***a* to cease further generation of the subsequent manifest request.

FIG. **6**B illustrates a second exemplary scenario associated with managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure. Referring to FIG. **6**B, there is illustrated a second exemplary scenario **600**B that corresponds to a fast start delivery model for segmented web video with enhanced features. In accordance with the second exemplary scenario **600**B, there is illustrated a second pre-encoded media asset **612** generated for the first client device, such as the client device **132***a*. There is shown a plurality of indexed programming content segments, such as PS **1**, . . . , PS Last, and a segment of non-scheduled programming content and/or non-programming content, for example an advertisement, in the second pre-encoded media asset **612**. An ad break is at a location L**1** between the programming content segments, such as PS **70** and PS **71**, in the second pre-encoded media asset **612**. There are further shown segments of enhanced features, hereinafter referred to as a plurality of event-based programming content segments, such as PSR **1**, . . . , PSR End, in the second pre-encoded media asset **612**. An example of one of the enhanced features may be previous episode recap, as illustrated in the second pre-encoded media asset **612**. The previous episode recap may be skipped-ahead based on an input received from the client device **132***a*.

In accordance with a first use case **614**, the client device **132***a* may be an old client with limited player integration with the SSAI system **109**. Further, the client device **132***a* may be incompatible with the required protocol version of modern streaming protocols, such as HLS and DASH. In such a use case, to ensure smooth and immediate video playback of the second pre-encoded media asset **612** at the client device **132***a*, the SSAI system **109** may communicate an initial pre-encoded media asset manifest, such as Manifest **1**, comprising an initial set of event-based programming content segments, such as PSR **1**, . . . , PSR **3**, to the client device **132***a*. The size of the initial set of event-based programming content segments, i.e., three programming content segments, is verified to be equal to the capacity of the playback buffer (typically 3) in the media player of the client device **132***a*. The client device **132***a* may generate a subsequent manifest request to update the initial pre-encoded media asset manifest, i.e. Manifest **1**. In response to the subsequent manifest request, the SSAI system **109** may add remaining event-based programming content segments, such as PSR **4**, . . . , PSR Last, and additional content segments, such as PSR End+1, . . . , PSR End+3 in the updated pre-encoded media asset manifest, such as Manifest **2**. The size of the additional content segments, i.e., three programming content segments, is verified to be equal to the capacity of the playback buffer (typically 3) in the media player of the client device **132***a*. Thus, the updated pre-encoded media asset manifest, i.e., Manifest **2**, includes all of the event-based programming content segments through the marked locations eligible for skipping plus a few additional content segments equal to the capacity of the playback buffer (typically 3) in the media player of the client device **132***a*. The SSAI system **109** may return the updated pre-encoded media asset manifest, i.e. Manifest **2** to the client device **132***a* for an immediate playback. Accordingly, the client device **132***a* may be allowed to skip the event-based programming content segments, such as PSR **1**, . . . , PSR Last, and begin the immediate playback from a segment, i.e., PSR End+1, after a marked end location of the plurality of event-based programming content segments, i.e., PSR End, upon receipt of an input from the client device **132***a* to skip the event-based programming content segments, i.e., PSR **1**, . . . , PSR End. The client device **132***a* continues the playback and again generates a subsequent manifest request for an updated pre-encoded media asset manifest, such as Manifest **3**, after a specified time duration controlled by the player-system integration.

In response to the subsequent manifest request, as the insertion of the advertisements is completed, the SSAI system **109** may add remaining programming content segments, such as till PS Last. The SSAI system **109** may further stitch the set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, of an advertisement at the location L**1** between the programming content segments PS **70** and PS **71**, in the final pre-encoded media asset manifest, such as Manifest **3**, as the defined criterion of completion of advertisement insertion is met. Accordingly, the SSAI system **109** may communicate the final pre-encoded media asset manifest, such as Manifest **3**, to the client device **132***a*. Further, the final pre-encoded media asset manifest, such as Manifest **3**, is designated to inform the media player of the client device **132***a* to cease further generation of the subsequent manifest request.

In accordance with a second use case **616**, the client device **132***a* may be a new client with complete player integration with the SSAI system **109**. Further, the client device **132***a* may be compatible with the required protocol version of modern streaming protocols, such as HLS and DASH. In such a use case, to ensure smooth and immediate video playback of the second pre-encoded media asset **612** at the client device **132***a*, the SSAI system **109** may communicate an initial pre-encoded media asset manifest, such as Manifest **1**, comprising event-based programming content

segments, i.e., PSR **1**, . . . , PSR End, and additional content segments, such as PSR End+1, . . . , PSR End+3, to the client device **132***a*.

Accordingly, the client device **132***a* may be allowed to begin the immediate playback from a segment, i.e., PSR End+1, after a marked end location of the plurality of event-based programming content segments, i.e., PSR End, upon receipt of an input from the client device **132***a* to skip the event-based programming content segments, i.e., PSR **1**, . . . , PSR End. The client device **132***a* continues the playback and again generates a subsequent manifest request for an updated pre-encoded media asset manifest, such as Manifest **2**, after a specified time duration controlled by the player-system integration.

In response to the subsequent manifest request, as the insertion of the advertisements is completed, the SSAI system **109** may add remaining programming content segments, such as till PS Last. The SSAI system **109** may further stitch the set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, of an advertisement at the location L**1** between the programming content segments PS **70** and PS **71**, in the final pre-encoded media asset manifest, such as Manifest **2**, as the defined criterion of completion of advertisement insertion is met. Accordingly, the SSAI system **109** may communicate the final pre-encoded media asset manifest, such as Manifest **2**, to the client device **132***a*. Further, the final pre-encoded media asset manifest, such as Manifest **2**, is designated to inform the media player of the client device **132***a* to cease further generation of the subsequent manifest request.

FIG. **6**C illustrates a third exemplary scenario associated with managing a pre-encoded media asset for immediate playback, in accordance with an exemplary embodiment of the disclosure. Referring to FIG. **6**C, there is illustrated a third exemplary scenario **600**C that corresponds to a fast start delivery model for segmented web video with early ad break. In accordance with the third exemplary scenario **600**C, there is illustrated a third pre-encoded media asset **622** generated for the first client device, such as the client device **132***a*. There is shown a plurality of indexed programming content segments, such as PS **1**, . . . , PS Last, and two sets of segments of non-scheduled programming content and/or non-programming content, for example advertisements, in the third pre-encoded media asset **622**. A first ad break occurs early and is at a location L**1** between the programming content segments PS **4** and PS **5**, and a second ad break is at a location L**2** between the programming content segments PS **80** and PS **81** in the third pre-encoded media asset **622**.

In accordance with a first use case **624**, the client device **132***a* may be an old client with limited player integration with the SSAI system **109**. Further, the client device **132***a* may be incompatible with the required protocol version of modern streaming protocols, such as HLS and DASH. In such a use case, to ensure smooth and immediate video playback of the third pre-encoded media asset **622** at the client device **132***a*, the SSAI system **109** may communicate an initial pre-encoded media asset manifest, such as Manifest **1**, comprising an initial set of programming content segments, such as PS **1**, . . . , PS **3**, to the client device **132***a*. The size of the initial set of programming content segments, i.e., three programming content segments, is verified to be equal to the capacity of the playback buffer (typically 3) in the media player of the client device **132***a*. The client device **132***a* may download and buffer the initial set of programming content segments, i.e., PS **1**, . . . , PS **3**, before the playback. While the client device **132***a* is downloading the initial set of programming content segments and begins an immediate playback, the SSAI system **109** may insert the non-programming content, such as advertisements, and programming content as well in the pre-encoded media asset manifest. Meanwhile, the client device **132***a* may generate a subsequent manifest request for an updated pre-encoded media asset manifest, such as Manifest **2**, after a specified time duration controlled by the player-system integration. In response to the subsequent manifest request, as the insertion of the advertisements is not yet completed, the SSAI system **109** may add additional content segments, such as PS **4** and PS **5**, and a set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, of the first advertisement to the initial pre-encoded media asset manifest, such as Manifest **1** and generate an updated pre-encoded media asset manifest, such as Manifest **2**. The SSAI system **109** may communicate the updated pre-encoded media asset manifest, such as Manifest **2**, comprising an updated set of programming content segments, such as PS **1**, . . . , PS **5**, and the set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, of the first advertisement to the client device **132***a*. The client device **132***a* continues the playback and again generates a subsequent manifest request for an updated pre-encoded media asset manifest, such as Manifest **3**, after a specified time duration controlled by the player-system integration.

In response to the subsequent manifest request, as the insertion of the advertisements is completed, the SSAI system **109** may add remaining programming content segments, such as PS **6**, . . . , PS Last. The SSAI system **109** may further stitch a set of non-programming content segments, such as NPS **4**, . . . , NPS **6**, of the remaining second advertisement at a location L**2** between the programming content segments PS **80** and PS **81**, and generate a final pre-encoded media asset manifest, such as Manifest **3**, as the defined criterion of completion of advertisement insertion is met. Accordingly, the SSAI system **109** may communicate the final pre-encoded media asset manifest, such as Manifest **3**, to the client device **132***a*. Further, the final pre-encoded media asset manifest, such as Manifest **3**, is designated to inform the media player of the client device **132***a* to cease further generation of the subsequent manifest request.

In accordance with a second use case **626**, the client device **132***a* may be a new client with complete player integration with the SSAI system **109**. Further, the client device **132***a* may be compatible with the required protocol version of modern streaming protocols, such as HLS and DASH. In such a use case, to ensure smooth and immediate video playback of the third pre-encoded media asset **622** at the client device **132***a*, the SSAI system **109** may communicate an initial pre-encoded media asset manifest, such as Manifest **1**, comprising an initial set of programming content segments, such as PS **1**, . . . , PS **5**, and a set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, of the first advertisement at the location L**1** between the programming content segments, such as PS **4** and PS **5**.

The client device **132***a* may download and buffer the initial set of programming content segments, i.e., PS **1**, . . . , PS **5**, and the set of non-programming content segments, such as NPS **1**, . . . , NPS **3**, before the playback. While the client device **132***a* is downloading the initial set of programming and non-programming content segments and begins an immediate playback, the SSAI system **109** may insert the remaining programming content and non-programming content, such as advertisements, in the pre-encoded media asset manifest. The client device **132***a* may generate a subsequent manifest request for an updated

pre-encoded media asset manifest, such as Manifest **2**, after a specified time duration controlled by the player-system integration. In response to the subsequent manifest request, as the insertion of the advertisements is completed, the SSAI system **109** may add remaining programming content segments, such as PS **6**, . . . , PS Last. The SSAI system **109** may further stitch a set of non-programming content segments, such as NPS **4**, . . . , NPS **6**, of the second advertisement at the location L**2** between the programming content segments, such as PS **80** and PS **81**, in a final pre-encoded media asset manifest, such as Manifest **2**, as the defined criterion of completion of advertisement insertion is met. Accordingly, the SSAI system **109** may communicate the final pre-encoded media asset manifest, such as Manifest **2**, to the client device **132***a*. Further, the final pre-encoded media asset manifest, such as Manifest **2**, is designated to inform the media player of the client device **132***a* to cease further generation of the subsequent manifest request.

In accordance with various embodiments as described in the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, the number of the updated pre-encoded media asset manifests (for both use cases) may be based on various factors, such as number of content placement opportunities in the first set of content placement opportunities, how many viewers need to respond for insertion in such number of content placement opportunities, a response from one Ad decisioning server to redirect to another Ad decisioning server for insertion of advertisements in the first set of content placement opportunities based on separation and capping rules, and/or user-defined configurable parameters on how long (such as 5 seconds) to wait for a response from a third-party Ad decisioning server. It may not be mandatory that the SSAI system **109** responds to the client device **132***a* with updated pre-encoded media asset manifests in each response. The SSAI system **109** may issue a notification indicating no change in the previously communicated pre-encoded media asset manifest if the SSAI system **109** is still waiting for the non-programming content from an Ad decisioning server or still inserting non-programming content in the previously updated pre-encoded media asset manifest. Thus, the number of manifests indicated in both the use cases in each of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C is merely for exemplary purposes and should not be construed to be limiting or deviating from the scope of the disclosure.

FIGS. **7**A to **7**E collectively depict a flowchart illustrating exemplary operations for managing a pre-encoded media asset for immediate playback by the SSAI system **109** of FIG. **1**D, in accordance with an exemplary embodiment of the disclosure. Specifically, flowchart **700**A depicts a method for generating a pre-encoded media asset for distribution, in accordance with an embodiment of the disclosure. Flowcharts **700**B to **700**E collectively depict a method for generating a set of pre-encoded media asset manifests for immediate playback by the SSAI system **109** of FIG. **1**D, in accordance with an exemplary embodiment of the disclosure.

Referring to flowchart **700**A, at **702**, a pre-encoded media asset comprising a plurality of programming content segments may be generated for distribution. In accordance with an embodiment, the content encoder/packager **107***a* may be configured to generate the pre-encoded media asset comprising a plurality of programming content segments for distribution. In accordance with various embodiments, without deviating from the scope of the disclosure, the distribution may be web distribution, broadcast, or satellite distribution.

The pre-encoded media asset generated for the distribution, for example, Internet distribution, may comprise a sequence of short duration programming content segments added to a pre-encoded media asset manifest. The short duration programming content segments may be separate physical files or pointers (real or to be calculated) to the short media content segments inside a larger file. In accordance with an embodiment, the content encoder/packager **107***a* may be directly coupled to the indexing and storage system (not shown in FIG. **1**C).

In accordance with various embodiments, corresponding to different exemplary scenarios, the content encoder/packager **107***a* may generate different pre-encoded media assets, each comprising a plurality of programming content segments, such as PS **1**, . . . , PS Last. Such exemplary scenarios may correspond to, for example, a fast start delivery model for segmented web video, a fast start delivery model for segmented web video with enhanced features, and a fast start delivery model for segmented web video with early ad break.

The content encoder/packager **107***a* may be configured to determine a package that includes a media content and associated metadata. The media content may correspond to one or more of programming content segments of the pre-encoded media assets transcoded to different types of streams for different types of devices, such as a TV or a mobile device, and marked with Nielson markers. The content encoder/packager **107***a* may encode and package such media content into required on-demand formats for delivery to the client devices **132***a*, . . . , **132***n*. Based on such a package, one or more encoded media assets may be dynamically generated for playout to one or more media players communicatively coupled through the content delivery system **130**.

The content encoder/packager **107***a* may be configured to publish the one or more encoded media assets, as one or more pre-encoded media assets, in real-time or near real-time in the content delivery system **130**. In accordance with an embodiment, the resulting converted output, i.e., one or more encoded media assets, that are generated by the content encoder/packager **107***a*, may be communicated to the indexing and storage system **116**. The content encoder/packager **107***a* may also support a robust interface (for example, ADI) that defines the on-demand duration of the individual segments as well as encryption requirements and a service type to link for ad insertion. Various formats of the pre-encoded media asset manifests may include, but are not limited to, HLS and DASH.

At **704**, based on metadata retrieved from the content metadata store **107***b*, the plurality of programming content segments may be adjusted in the pre-encoded media asset. In accordance with an embodiment, the content encoder/packager **107***a* may be configured to adjust the plurality of programming content segments in the pre-encoded media asset based on the metadata retrieved from the content metadata store **107***b*. In other words, the metadata from the content metadata store **107***b* may be used to condition the pre-encoded media asset to provide clean locations in the pre-encoded media asset manifest where ads can be inserted. In accordance with another embodiment, the metadata from the content metadata store **107***b* may be used to condition the pre-encoded media asset to provide clean locations for event-based programming content, such as opening credits

and previous episode recaps, so that such event-based programming content can be skipped when the customer is binging multiple episodes.

Examples of the metadata may include a pre-encoded media asset identifier, a title of the pre-encoded media asset, type of the pre-encoded media asset (such as movie series (season episode number)), genre, plot summary, duration, advertisement break locations, credit locations, scene descriptions, a short summary of the programming content segments, a short summary of ideal advertisement placements within the pre-encoded media asset, a file format, DRM, encryption information, length of the pre-encoded media asset, a date and/or time the pre-encoded media asset was added to the catalog of pre-encoded media assets, a new item indicator for the pre-encoded media asset (for example, a new pre-encoded media asset that became available within the last 24 hours, last few days, last week, and/or the like), and/or a pre-encoded asset class (for example, a television show, a cartoon program, a movie, a news media, an episode, a game, a curated clip, a recorded sports event, interactive media, and/or the like). Other forms of metadata may be utilized without departing from the spirit and scope of the various embodiments of the disclosure.

In accordance with an embodiment, the adjustment of the plurality of programming content segments may provide a first set of content placement opportunities where the plurality of non-programming content may be inserted in the pre-encoded media asset manifest. In accordance with various examples, the non-programming content may correspond to ad breaks or promotional content. The first set of content placement opportunities may correspond to, for example, non-programming indicators (such as indicators corresponding to commercial advertisements, non-commercial advertisements, paid advertisements, public service advertisements, and/or promotional material). In accordance with another embodiment, the adjustment of the plurality of programming content segments may provide a second set of content placement opportunities where event-based programming content may occur in the pre-encoded media asset manifest. In accordance with various examples, the event-based programming content may correspond to an identifier corresponding to an event related to the content. The second set of content placement opportunities correspond to, for example, event markers (such as markers corresponding to opening credits, closing credits, previous episode recaps, timing, and/or other similar skippable media content).

In accordance with an exemplary embodiment, with reference to the first exemplary scenario **600**A in FIG. **6**A, the content encoder/packager **107***a* may adjust the plurality of programming content segments, such as PS **1**, . . . , PS Last, based on the metadata. Accordingly, the first ad break is determined to be at a location L**1** between the programming content segments PS **50** and PS **51**, and a second ad break is at a location L**2** between the programming content segments PS **110** and PS **111**, as illustrated in the first pre-encoded media asset **602**.

In accordance with another exemplary embodiment, with reference to the second exemplary scenario **600**B in FIG. **6**B, the content encoder/packager **107***a* may adjust the plurality of event-based programming content segments, such as PSR **1**, . . . , PSR End, and programming content segments, such as PS **1**, . . . , PS Last, based on the metadata. Accordingly, the ad break is determined to be at a location L**1** between the programming content segments PS **70** and PS **71**, as illustrated in the second pre-encoded media asset **612**.

In accordance with yet another exemplary embodiment, with reference to the third exemplary scenario **600**C in FIG. **6**C, the content encoder/packager **107***a* may adjust the plurality of programming content segments, such as PS **1**, . . . , PS Last, based on the metadata. Accordingly, the first ad break is determined to be early at a location L**1** between the programming content segments PS **4** and PS **5**, and a second ad break is at a location L**2** between the programming content segments PS **80** and PS **81**, as illustrated in the third pre-encoded media asset **622**.

At **706**, timestamps of the first set of content placement opportunities and the second set of content placement opportunities may be stored in the metadata upon the generation of the pre-encoded media asset. In accordance with an embodiment, the content encoder/packager **107***a* may be configured to store the timestamps of the first set of content placement opportunities and the second set of content placement opportunities in the metadata upon the generation of the pre-encoded media asset. In other words, the time of the ad locations, such as L**1** and L**2**, and the event-based programming content may be noted by the content encoder/packager **107***a* and may be provided back to the content metadata store **107***b* once the pre-encoded media asset is created.

At **708**, a start location and an end location of each of first set of content placement opportunities and second set of content placement opportunities may be marked in the pre-encoded media asset manifest. In accordance with an embodiment, the content encoder/packager **107***a* may be configured to mark the start location and the end location of each of the first set of content placement opportunities and the second set of content placement opportunities in the pre-encoded media asset manifest. In other words, the content encoder/packager **107***a* may be configured to mark the ad locations and the event-based programming content in the pre-encoded media asset manifest itself to avoid the need for extra calls and calculations during the ad insertion process or for identification of such event-based programming content, respectively.

For example, with reference to FIGS. **6**A to **6**C, the start location of the first ad break determined to be at a location L**1** may be marked as $L1_{start}$ and the end location may be marked as $L1_{End}$ in the pre-encoded media asset manifests of each of the first pre-encoded media asset **602**, the second pre-encoded media asset **612**, and the third pre-encoded media asset **622**. With reference to FIG. **6**B, the start location of the event-based programming content may be marked as E_{start} which may be zero, as the event-based programming content, for example, previous episode recap occurs at the beginning of the second pre-encoded media asset **612**. The end location may be marked as E_{End} based on a time offset associated with the event-based programming content.

At **710**, the pre-encoded media asset manifest may be stored in a content delivery system and/or internal manifest index. In accordance with an embodiment, the content encoder/packager **107***a* may be configured to store the pre-encoded media asset manifest in the content delivery system **130** and/or the internal manifest index **109***a*. In other words, in one example embodiment, the content encoder/packager **107***a* may push the pre-encoded media asset manifest to the content delivery system **130**. In another example embodiment, the content encoder/packager **107***a* may register the pre-encoded media asset manifest with the SSAI system **109** and store the pre-encoded media asset manifest in the internal manifest index **109***a*.

Referring to flowcharts **700**B to **700**E, at **714**, an initial manifest request may be received from a first client device to view a pre-encoded media asset. In accordance with an embodiment, the SSAI system **109** may be configured to receive the initial manifest request from the first client device, such as the client device **132***a*, to view a pre-encoded media asset. In other words, when the client device **132***a* requests to view a desired pre-encoded media asset, the initial manifest request is directed to the SSAI system **109**. Various examples of the client device **132***a* may include, but are not limited to, a personal computer, a smartphone, a tablet, an over-the-top (OTT) set-top, or a hybrid set-top on which a user launches a web page, an application, or a service to view the pre-encoded media asset, such as a VOD.

In accordance with an embodiment, the initial manifest request may be associated with one of the various scenarios, as described above in FIGS. **6**A to **6**C, that correspond to an immediate playback of a pre-encoded media asset. In accordance with an embodiment, the initial manifest request may include additional data, such as device identifier of the first client device, device type of the first client device, user preferences, preferred date and time of viewing the pre-encoded media asset, and/or capacity of the playback buffer of the first client device.

At **716**, a pre-encoded media asset manifest, based on the received initial manifest request, may be accessed from the content delivery system **130** or the internal manifest index **109***a*. In accordance with an embodiment, the SSAI system **109** may be configured to access the pre-encoded media asset manifest, based on received initial manifest request, from the content delivery system **130** or the internal manifest index **109***a*. In one example embodiment, the SSAI system **109** requests a pre-encoded media asset manifest corresponding to the desired pre-encoded media asset from the content delivery system **130** on behalf of the first client device, such as the client device **132***a*, based on the additional data included in the received initial manifest request. In another example embodiment, if the pre-encoded media asset manifest corresponding to the desired pre-encoded media asset was previously registered, the SSAI system **109** accesses the pre-encoded media asset manifest from the internal manifest index **109***a*.

At **718**, an instruction, based on targeting and/or non-targeting parameters, an external system, and/or a set of pre-determined rules, may be received. In accordance with an embodiment, the SSAI system **109** may be configured to receive an instruction, based on the targeting and/or non-targeting parameters, the external system, and/or the set of pre-determined rules. In accordance with an exemplary embodiment, the SSAI system **109** may be instructed, via the targeting and/or non-targeting parameters, the external system, and/or the set of pre-determined rules, for determining whether all the non-scheduled programming content and/or non-programming content will be inserted as a single response to the first client device, such as the client device **132***a*, as per the operation at **722**. In accordance with another exemplary embodiment, the SSAI system **109** may be instructed, via the targeting and/or non-targeting parameters, the external system, and/or the set of pre-determined rules, for returning an initial pre-encoded media asset manifest, inclusive of or independent of the non-scheduled programming content and/or non-programming content, to the first client device, such as the client device **132***a*. The decision about including or excluding the non-scheduled programming content and/or non-programming content may be based on capability of the client device **132***a* that may be determined by the operation at **724**.

The targeting and non-targeting parameters may comprise metadata associated with the pre-encoded media asset, data associated with the first client device, and/or data associated with scheduling window of the pre-encoded media asset. Non-limiting examples of the metadata may include advertisement break locations, enhanced programming event markers, locations for inserting non-scheduled programming content in the pre-encoded media asset. Non-limiting examples of the data associated with the first client device may include session identifiers, date and time of client requests, length/duration of client session (such as 4-hour session or 1-hour session), and date and time of viewing a media content. Non-limiting examples of data associated with the scheduling window of the pre-encoded media asset (that is to be played) may include business rules associated with the scheduling window (for example, if the pre-encoded media asset is to be viewed the next day, what would be the 12^{th} asset when played back), availability of a pre-encoded media asset before playback, or promotional content in the pre-encoded media asset that is to be dynamically included or automatically updated once the playback of programming segments begins. The external system may correspond to one or more of the Ad decisioning servers **106***a*, . . . , **106***n*. The set of pre-determined rules may correspond to rules about what is to be inserted as non-scheduled programming content (provided by the CDS **105**) and/or non-programming content (provided by the Ad decisioning servers **106***a*, . . . , **106***n*).

At **720**, the type of instruction may be identified. In accordance with an embodiment, the SSAI system **109** may be configured to identify the type of the instruction. In one exemplary embodiment, the type of instruction may be a first instruction corresponding to insertion of all the non-scheduled programming content and/or non-programming content upon the initial and final response to the first client device, such as the client device **132***a*, for playback the pre-encoded media asset. In such an embodiment, the control passes to the operation at **722**. In one exemplary embodiment, the type of instruction may be a second instruction corresponding to enabling the immediate playback of the pre-encoded media asset at the first client device. In such an embodiment, the control passes to the operation at **724**.

At **722**, each non-scheduled programming content and/or non-programming content may be inserted in the pre-encoded media asset manifest as an initial and final response to the initial manifest request for the playback of the pre-encoded media asset at the first client device in accordance with the first instruction, based on the targeting and/or non-targeting parameters, the external system, and/or the set of pre-determined rules. In accordance with an embodiment, in accordance with the first instruction, the SSAI system **109** may be configured to insert each non-scheduled programming content and/or non-programming content in the pre-encoded media asset manifest as an initial and final response to the initial manifest request for the playback of the pre-encoded media asset at the first client device, such as the client device **132***a*, in accordance with the first instruction, based on the targeting and/or non-targeting parameters, the external system, and/or the set of pre-determined rules.

In such an embodiment, a final pre-encoded media asset manifest may be generated directly as a single response to the client device **132***a*. Thereafter, the control passes to the operation at **742** in flowchart **700**D. The operations at **742** followed by the operations at **744**, **746**, and **748** may be executed without the requirement of any subsequent manifest request.

At **724**, capability of the first client device may be determined based on the targeting and/or non-targeting parameters, the external system and/or the set of pre-determined rules. In accordance with an embodiment, the SSAI system **109** may be configured to determine the capability of the first client device, such as the client device **132***a*, based on the targeting and/or non-targeting parameters, the external system and/or the set of pre-determined rules. The capability of the first client device may correspond to an extent of player integration with the system and compatibility of the first client device, such as the client device **132***a*, with a required protocol version. The extent of the player integration may control various functionalities, for example, informing the media player of the first client device to start playback from the beginning of the pre-encoded media asset, controlling when the media player should request updated pre-encoded media manifests, and presenting data indicating the entire pre-encoded media asset duration, and the like. The compatibility of the first client device, such as the client device **132***a*, with the required protocol version, such as HLS v7. Based on the compatibility of the first client device with the required protocol version, various #tags, features and attributes, such as #EXT-X-DATERANGE, #EXT-X-SESSION-KEY, E-AC-3 codec support, and SCTE-35 signalling, may be supported.

At **726**, the extent of player integration with system and compatibility with required protocol may be determined. In accordance with an embodiment, the SSAI system **109** may be configured to determine the extent of the player integration with the SSAI system **109** and compatibility with the required protocol. In one exemplary embodiment, the extent of player integration with the SSAI system **109** is limited and the first client device, such as the client device **132***a*, is incompatible with the required protocol version. In such an embodiment, the control passes to the operation at **728**. In another exemplary embodiment, the extent of player integration with the SSAI system **109** is complete and the first client device, such as the client device **132***a*, is compatible with the required protocol version, In such an embodiment, the control passes to the operation at **730**.

At **728**, in case the extent of the player integration with the system is limited and the first client device is incompatible with the required protocol, an initial pre-encoded media asset manifest may be generated that comprises an initial set of programming content segments based on the receipt of an initial manifest request from the first client device. The size of the initial set of programming content segments is verified to be equal to capacity of the playback buffer in the media player of the first client device. In accordance with an embodiment, the SSAI system **109** may be configured to generate, based on the receipt of an initial manifest request from the first client device (such as the client device **132***a*), the initial pre-encoded media asset manifest that comprises the initial set of programming content segments. In such an embodiment, the initial pre-encoded media asset manifest may be independent of non-scheduled programming content and/or the non-programming content. The initial pre-encoded media asset manifest may enable the immediate playback of the pre-encoded media asset at the first client device in accordance with the second instruction. The initial pre-encoded media asset manifest may be based on the targeting and/or non-targeting parameters, an external system, and/or a set of pre-determined rules. An equality between the size of the initial set of programming content segments and the capacity of the playback buffer may facilitate the immediate playback at the first client device, such as the client device **132***a*, from beginning of the pre-encoded media asset.

In an example, with reference to the first use case **604** of the first exemplary scenario **600**A in FIG. **6**A, the SSAI system **109** may generate the initial pre-encoded media asset manifest, i.e., Manifest **1**, that comprises the initial set of programming content segments, such as PS **1**, . . . , PS **3**. In another example, with reference to the first use case **624** of the third exemplary scenario **600**C in FIG. **6**C, the SSAI system **109** may generate the initial pre-encoded media asset manifest, i.e., Manifest **1**, that comprises the initial set of programming content segments, such as PS **1**, . . . , PS **3**.

At **730**, in case the extent of the player integration with the system is complete and the first client device is compatible with the required protocol, an initial pre-encoded media asset manifest may be generated that comprises an initial set of programming content segments up to a first content placement opportunity from the first set of content placement opportunities marked for insertion of a first non-scheduled programming content and/or non-programming content. The initial pre-encoded media asset manifest may be generated based on the receipt of the initial manifest request from the first client device. In accordance with an embodiment, the SSAI system **109** may be configured to generate, based on the receipt of the initial manifest request from the first client device (such as the client device **132***a*), the initial pre-encoded media asset manifest that comprises the initial set of programming content segments up to the first content placement opportunity marked for insertion of the non-scheduled programming content and/or the non-programming content. In such an embodiment, the initial pre-encoded media asset manifest may be independent of non-scheduled programming content and/or the non-programming content. The initial pre-encoded media asset manifest may enable the immediate playback of the pre-encoded media asset at the first client device in accordance with the second instruction. The initial pre-encoded media asset manifest may be based on the targeting and/or non-targeting parameters, an external system, and/or a set of pre-determined rules.

For example, with reference to the second use case **606** of the first exemplary scenario **600**A in FIG. **6**A, the SSAI system **109** may generate the initial pre-encoded media asset manifest, i.e., Manifest **1**, that comprises the initial set of programming content segments, such as PS **1**, . . . , PS **50** up to the first content placement opportunity, such as the first ad break at location L**1**, marked for insertion of the non-programming content. The control passes to the operation at **732**.

In accordance with an embodiment, the SSAI system **109** may be configured to communicate a signal to the media player of the first client device, such as the client device **132***a*, to start the immediate playback from beginning of the pre-encoded media asset based on the complete player integration.

In accordance with an embodiment, the SSAI system **109** may be configured to control a timing of the subsequent manifest request to be generated by the media player of the first client device, such as the client device **132***a* based on the complete player integration. In other words, the complete player integration with the first client device, such as the client device **132***a*, may control when the media player should request an updated pre-encoded media asset manifests, as if fast forwarding to near the end of the programming content segments communicated in the initial pre-encoded media asset manifest.

In accordance with an embodiment, the SSAI system **109** may be configured to provide data indicating an entire duration of the pre-encoded media asset to the media player of the first client device, such as the client device **132***a*.

At **732**, the generated initial pre-encoded media asset manifest may be communicated, as a first disparate live media output stream manifest, to the media player of the first client device via the content delivery system **130** for an immediate playback of the pre-encoded media asset. The initial pre-encoded media asset manifest may be communicated as the first disparate live media output stream manifest to the first client device based on one of pre-defined conversion modes. In accordance with an embodiment, the SSAI system **109** may be configured to communicate the generated initial pre-encoded media asset manifest, as the first disparate live media output stream manifest, to the media player of the first client device (such as the client device **132***a*) via the content delivery system **130** for an immediate playback of the pre-encoded media asset.

For example, with reference to the first use cases **604**, **614**, and **624** and the second use case **606** as described above, the SSAI system **109** may communicate the generated initial pre-encoded media asset manifest, i.e. Manifest **1**, as the first disparate live media output stream manifest, to the media player of the client device **132***a*, via the content delivery system **130**, for an immediate playback of the pre-encoded media assets **602**, **612**, and **622**, respectively.

In accordance with an embodiment, the pre-defined conversion modes may correspond to a pre-encoded media assets to live stream mode or a pre-encoded media assets to live stream mode with scalable architecture. The conversion may facilitate a subsequent modification to the first disparate live media output stream. The subsequent modification may correspond to one of a user selection, a user preference, or a change in a time or geolocation-based rule.

At **734**, the initial pre-encoded media asset manifest may be designated to inform the media player of the first client device to generate a subsequent manifest request. In accordance with an embodiment, the SSAI system **109** may be configured to designate the initial pre-encoded media asset manifest to inform the media player of the first client device (such as the client device **132***a*) to generate the subsequent manifest request as if it were a live or an event stream. The generated subsequent manifest request may be received by the SSAI system **109** and the SSAI system **109** responds to the subsequent manifest request by updating the initial pre-encoded media asset manifest.

For example, with reference to the first use cases **604**, **614**, and **624** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, respectively, the SSAI system **109** may designate the respective initial pre-encoded media asset manifests, i.e., Manifest **1**, to generate a subsequent manifest request for updated pre-encoded media asset manifests, i.e., Manifest **2**. Similarly, with reference to the second use cases **606**, **616**, and **626** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, respectively, the SSAI system **109** may designate the respective initial pre-encoded media asset manifests, i.e., Manifest **1**, to generate a subsequent manifest request for updated pre-encoded media asset manifests, i.e., Manifest **2**.

At **736**, a unique SID may be assigned to the first client device to record a session of the first client device for the subsequent manifest request or a final manifest request associated with the initial manifest request. In accordance with an embodiment, the SSAI system **109** may be configured to assign the unique SID to the first client device (such as the client device **132***a*) to record a session of the first client device for the subsequent manifest request or the final manifest request associated with the initial manifest request.

At **738**, receipt of information regarding each of the non-scheduled programming content and/or non-programming content from corresponding servers may be verified. In accordance with an embodiment, the SSAI system **109** may be configured to verify the receipt of the information regarding each of the non-scheduled programming content and/or the non-programming content from corresponding servers, such as the CDS **105** and one or more of the Ad decisioning servers **106***a*, . . . , **106***n*.

In an exemplary embodiment, the receipt of the information regarding each of the non-scheduled programming content and/or the non-programming content is verified. In such an embodiment, the control passes to the operation at **740**. In another exemplary embodiment, the receipt of the information regarding each of the non-scheduled programming content and/or the non-programming content is not verified. In such an embodiment, the control loops back to operation at **738** and waits until the SSAI system **109** verifies the receipt of the required information. In such a case, the SSAI system **109** may issue a notification to the client device **132***a* indicating no change in the previously communicated pre-encoded media asset manifest as the SSAI system **109** is still waiting for the non-programming content from one or more of the Ad decisioning servers **106***a*, . . . , **106***n*.

For example, the SSAI system **109** may verify the receipt of the information regarding each non-programming content, such as the first advertisement and/or the second advertisement, in the pre-encoded media asset, such as the first pre-encoded media asset **602**, the second pre-encoded media asset **612**, and/or the third pre-encoded media asset **622**, from the one or more of the Ad decisioning servers **106***a*, . . . , **106***n*.

At **740**, it may be determined whether insertion of each of the non-scheduled programming content and/or the non-programming content is complete or incomplete in the updated pre-encoded media asset manifest based on the received information. In accordance with an embodiment, the SSAI system **109** may be configured to determine whether the insertion of each of the non-scheduled programming content and/or the non-programming content is complete or incomplete in the updated pre-encoded media asset manifest based on the received information.

In an exemplary embodiment, the insertion of each of the non-scheduled programming content and/or the non-programming content is determined to be complete in the updated pre-encoded media asset manifest. In such an embodiment, the control passes to the operation at **742**. In another exemplary embodiment, the insertion of each of the non-scheduled programming content and/or the non-programming content is determined to be incomplete. The SSAI system **109** may start the insertion of the non-scheduled programming content and/or the non-programming content in the updated pre-encoded media asset manifest, i.e., Manifest **2**, while the client device **132***a* is downloading the set of programming content segments in the previous pre-encoded media asset manifest, i.e., Manifest **1**, and begins the playback. In such an embodiment, the control passes to the operation at **750** in flowchart **700**E.

At **742**, a final pre-encoded media asset manifest may be generated upon receipt of the subsequent manifest request from the first client device based on a defined criterion. In accordance with an embodiment, the SSAI system **109** may be configured to generate the final pre-encoded media asset

manifest upon the receipt of the subsequent manifest request from the first client device, such as the client device **132***a*, based on the defined criterion. The defined criterion may correspond to the determination that the insertion of the non-scheduled programming content and/or the non-programming content in the final pre-encoded media asset manifest is complete. Thus, the updated pre-encoded media asset manifest, i.e., Manifest **2**, may be generated as the final pre-encoded media asset manifest when the insertion of each of the non-scheduled programming content and/or the non-programming content is completed by the time the subsequent manifest request is received by the SSAI system **109**.

In accordance with an embodiment, the final pre-encoded media asset manifest may comprise remaining programming content segments corresponding to the pre-encoded media asset, non-scheduled programming content segments corresponding to each non-scheduled programming content, and non-programming content segments corresponding to each non-programming content based on targeting and/or non-targeting parameters. For example, the Manifest **2**, as illustrated in the second use case **606** of the first exemplary scenario **600**A, may include the remaining programming content segments, such as PS **51**, . . . , PS Last, and non-programming content segments, such as NPS **1**, . . . , NPS **6**. Similarly, the Manifest **2**, as illustrated in the second use case **626** of the third exemplary scenario **600**C, may include the remaining programming content segments, such as PS **6**, . . . , PS Last, and non-programming content segments, such as NPS **4**, . . . , NPS **6**.

In accordance with an embodiment, the final pre-encoded media asset manifest may include references to the set of non-scheduled programming content segments and/or non-programming content segments corresponding to each non-scheduled programming content and/or non-programming content respectively, inserted at a first set of content placement opportunities defined in the metadata.

At **744**, the final pre-encoded media asset manifest may be communicated to the first client device in response to the subsequent manifest request when the defined criterion is met. In accordance with an embodiment, the SSAI system **109** may be configured to communicate the final pre-encoded media asset manifest to the first client device, such as the client device **132***a*, in response to the subsequent manifest request when the defined criterion is met. For example, Manifest **2**, as generated in the second use cases **606** and **626** of the first exemplary scenario **600**A and the third exemplary scenario **600**C, respectively, is communicated by the SSAI system **109** to the client device **132***a* as the final pre-encoded media asset manifest, as the insertion of the each of non-scheduled programming content is complete in the Manifest **2**.

At **746**, the final pre-encoded media asset manifest may be designated to inform the media player of the first client device to cease further generation of the subsequent manifest request. In accordance with an embodiment, the SSAI system **109** may be configured to designate the final pre-encoded media asset manifest to inform the media player of the first client device, such as the client device **132***a*, to cease further generation of the subsequent manifest request. In other words, the final pre-encoded media asset manifest may be designated to inform the media player that there is no longer a need to request further updated pre-encoded media asset manifests.

At **748**, the initial, the updated, and/or the final pre-encoded media asset manifests may be stored as a set of asset manifests corresponding to the unique SID for a designated period of time when the receipt of the information regarding each of the non-scheduled programming content and/or the non-programming content is verified, the insertion of each of the non-scheduled programming content and/or the non-programming content is determined to be complete, and the final pre-encoded media asset manifest is communicated to the first client device. In accordance with an embodiment, the SSAI system **109** may be configured to store the initial, the updated, and/or the final pre-encoded media asset manifests as a set of asset manifests corresponding to the unique SID for the designated period of time when the receipt of the information regarding each of the non-scheduled programming content and/or the non-programming content is verified, the insertion of each of the non-scheduled programming content and/or the non-programming content is determined to be complete, and the final pre-encoded media asset manifest is communicated to the first client device, such as the client device **132***a*.

The set of asset manifests may be stored based on a duration of the pre-encoded media asset upon receipt of a request of a different profile from the media player of the first client device, such as the client device **132***a*, based on connectivity changes of the first client device. Thereafter, the SSAI system **109** may be configured to stop all other processing related to the unique SID.

At **750**, it may be determined whether the pre-encoded media asset manifest and/or the metadata include a second set of content placement opportunities. In accordance with an embodiment, the SSAI system **109** may be configured to determine whether the pre-encoded media asset manifest and/or the metadata include the second set of content placement opportunities. In an exemplary embodiment, the pre-encoded media asset manifest and/or the metadata includes the second set of content placement opportunities. In such an embodiment, the control passes to the operation at **752**. In another exemplary embodiment, the pre-encoded media asset manifest and/or the metadata does not include the second set of content placement opportunities. In such an embodiment, the control passes to the operation at **756**.

At **752**, a plurality of event-based programming content segments and additional content segments may be added in the updated pre-encoded media asset manifest when the pre-encoded media asset manifest and/or the metadata includes the second set of content placement opportunities where event-based programming content occurs in the pre-encoded media asset manifest. In accordance with an embodiment, the SSAI system **109** may be configured to add the plurality of event-based programming content segments and the additional content segments in the updated pre-encoded media asset manifest when the pre-encoded media asset manifest and/or the metadata includes the second set of content placement opportunities where event-based programming content occurs in the pre-encoded media asset manifest. The size of the additional content segments matches with capacity of a playback buffer in the media player of the first client device, such as the client device **132***a*. In other words, in presence of one or more markings in the pre-encoded media asset manifest or external data, such as the metadata, indicting the location of skippable items, such as opening credits, or a recap of previous episodes, the initial pre-encoded media asset manifest may include all of the programming content segments through the marked locations eligible for skipping plus a few additional content segments equal to the playback buffer in the media player of the first client device, such as the client device **132***a*.

For example, with reference to the first use case **614** of the second exemplary scenario **600**B in FIG. **6**B, the SSAI

system **109** may add event-based programming content segments, such as PSR **4**, . . . , PSR End, and additional content segments, such as PSR End+1, . . . , PSR End+3, in the updated pre-encoded media asset manifest, i.e. Manifest **2**. The initial pre-encoded media asset manifest, i.e. Manifest **1**, comprises only three event-based programming content segments, such as PSR **1**, . . . , PSR **3**, and is not eligible for playback.

At **754**, the media player of the first client device may be allowed to begin an immediate playback after the marked end location of the plurality of event-based programming content segments upon a receipt of an input from the first client device to skip the event-based programming content. In accordance with an embodiment, the SSAI system **109** may be configured to allow the media player of the first client device, such as the client device **132***a*, to begin the immediate playback after the marked end location of the plurality of event-based programming content segments upon a receipt of an input from the first client device, such as the client device **132***a*, to skip the event-based programming content. The immediate playback starts from a beginning of the additional content segments in the updated pre-encoded media asset manifest. In other words, the media player may be allowed to begin the playback after the event-based programming content segments marked as skippable if the viewer elects to skip the event-based programming. The additional segments may be needed to maintain the video buffer of the media player for a smooth playback. The control passes to the operation at **760**.

For example, with reference to the first use case **614** of the second exemplary scenario **600**B in FIG. **6**B, the SSAI system **109** may allow the client device **132***a* to begin the immediate playback from a segment, i.e., PSR End+1, after a marked end location of the plurality of event-based programming content segments, i.e., PSR End, upon receipt of an input from the client device **132***a* to skip the event-based programming content segments, i.e., PSR **1**, . . . , PSR End.

At **756**, additional content segments corresponding to the pre-encoded media asset, the non-scheduled programming content segments and/or the non-programming content segments may be added in the updated pre-encoded media asset manifest to provide additional time duration. In accordance with an embodiment, the SSAI system **109** may be configured to add the additional content segments corresponding to the pre-encoded media asset, the non-scheduled programming content segments and/or the non-programming content segments in the updated pre-encoded media asset manifest to provide additional time duration. Such an embodiment may be realized when the SSAI system **109** determines that the pre-encoded media asset manifest and/or the metadata does not include the second set of content placement opportunities.

In an example, with reference to the first use case **604** of the first exemplary scenario **600**A in FIG. **6**A, the SSAI system **109** may generate the updated pre-encoded media asset manifest, i.e., Manifest **2**, that comprises the additional programming content segments, such as PS **4** and PS **5** to provide additional time duration. With reference to the second use case **606** of the first exemplary scenario **600**A in FIG. **6**A, the SSAI system **109** may generate the updated pre-encoded media asset manifest, i.e., Manifest **2**, that comprises the additional programming content segments, such as PS **51** and PS Last to provide additional time duration.

In another example, with reference to the first use case **624** of the third exemplary scenario **600**C in FIG. **6**C, the SSAI system **109** may generate the updated pre-encoded media asset manifest, i.e., Manifest **2**, that comprises the additional programming content segments, such as PS **4** and PS **5** and also the non-programming content segments, such as NPS **1**, . . . , NPS **3**, which occurs early, i.e., after the fourth programming content segment only. With reference to the second use case **626** of the third exemplary scenario **600**C in FIG. **6**C, the SSAI system **109** may generate the updated pre-encoded media asset manifest, i.e., Manifest **2**, that comprises the additional programming content segments, such as PS **6** and PS Last.

At **758**, in the additional time duration, the insertion of the non-scheduled programming content and/or the non-programming content in the updated pre-encoded media asset manifest may be completed at a portion of or an entire first set of content placement opportunities defined in the metadata. In accordance with an embodiment, the SSAI system **109** may be configured to complete the insertion of the non-scheduled programming content and/or the non-programming content in the updated pre-encoded media asset manifest at a portion of or an entire first set of content placement opportunities defined in the metadata. The insertion may be completed in the additional time duration. For example, in absence of any marking in the pre-encoded media asset manifest or external data, such as metadata, indicting the location of skippable items, such as opening credits, or a recap of previous episodes, the updated pre-encoded media asset manifest may include sufficient programming content segments to provide the SSAI system **109** some more time to complete the insertion of the advertisements for the defined break locations in the final pre-encoded media asset manifest.

With reference to the second use case **606** of the first exemplary scenario **600**A in FIG. **6**A, the SSAI system **109** may complete the insertion of the non-programming content, such as NPS **1**, . . . , NPS **3**, and NPS **4**, . . . , NPS **6**, in the updated pre-encoded media asset manifest, such as Manifest **2**, at the first set of content placement opportunities, such as locations L**1** and L**2**, respectively, defined in the metadata.

In an example, with reference to the first use case **624** of the third exemplary scenario **600**C in FIG. **6**C, the SSAI system **109** may complete the insertion of the non-programming content, such as NPS **1**, . . . , NPS **3**, in the updated pre-encoded media asset manifest, such as Manifest **2**, at a portion of the first set of content placement opportunities, such as location L**1**, defined in the metadata. With reference to the second use case **626** of the third exemplary scenario **600**C in FIG. **6**C, the SSAI system **109** may complete the insertion of the non-programming content, such as NPS **1**, . . . , NPS **3**, and NPS **4**, . . . , NPS **6**, in the updated pre-encoded media asset manifest, such as Manifest **2**, at the first set of content placement opportunities, such as locations L**1** and L**2**, respectively, defined in the metadata.

At **760**, an updated pre-encoded media asset manifest may be communicated to the first client device in response to an updated manifest request. In accordance with an embodiment, the SSAI system **109** may be configured to communicate the updated pre-encoded media asset manifest to the first client device, such as the client device **132***a*, in response to the updated manifest request. For example, with reference to the first use cases **604**, **614**, and **624** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, respectively, Manifest **2** may be communicated to the first client device, such as the client device **132***a*. Similarly, with reference to the second use cases **606**, **616**, and **626** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third

exemplary scenario **600**C, respectively, Manifest **2** may be communicated to the first client device, such as the client device **132***a*.

At **762**, the updated pre-encoded media asset manifest may be designated to inform the media player of the first client device to generate the subsequent manifest request or the final manifest request. In accordance with an embodiment, the SSAI system **109** may be configured to designate the updated pre-encoded media asset manifest to inform the media player of the first client device, such as the client device **132***a*, to generate the subsequent manifest request or the final manifest request. The updated pre-encoded media asset manifest may continue to be designated to inform the media player of the first client device, such as the client device **132***a*, of a need to request updated pre-encoded media asset manifest as if it were a live or event stream.

In an example, with reference to the first use cases **604**, **614**, and **624** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, respectively, the SSAI system **109** may designate the updated pre-encoded media asset manifest, i.e., Manifest **2**, to inform the media player of the first client device, such as the client device **132***a*, to generate the subsequent manifest request or a final manifest request. In another example, with reference to the second use cases **606**, **616**, and **626** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, respectively, the SSAI system **109** may designate the updated pre-encoded media asset manifest, i.e., Manifest **2**, to inform the media player of the first client device, such as the client device **132***a*, to generate the subsequent manifest request. In both the examples above, the subsequent manifest request may correspond to generation of the subsequent manifest request or a final manifest request.

Such cycle is continually repeated and the control passes back to operation **740** in flowchart **700**D until the final pre-encoded media asset manifest with the non-scheduled programming content and/or the non-programming content can be generated based on the defined criteria and the final pre-encoded media asset manifest is communicated to the first client device, such as the client device **132***a*. For example, at **740**, with reference to the second use cases **606**, **616**, and **626** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, respectively, the SSAI system **109** may determine that the insertion of the non-programming content is complete and the defined criteria is met. Thus, the SSAI system **109** may generate the final pre-encoded media asset manifests corresponding to Manifest **2**, communicate the final pre-encoded media asset manifests to the client device **132***a*, designate the final pre-encoded media asset manifests to inform the client device **132***a* to cease further generation of subsequent requests, and store the initial, updated and the final pre-encoded media asset manifests for designated period of time. However, at **740**, with reference to the first use cases **604**, **614**, and **624** of the first exemplary scenario **600**A, the second exemplary scenario **600**B, and the third exemplary scenario **600**C, respectively, the SSAI system **109** may determine that the insertion of the non-programming content is incomplete and the defined criteria is not met. Thus, control passes to the operation at **750** to repeat the generation of updated pre-encoded media asset manifests until the insertion of the non-programming content is complete and the defined criteria is met.

Various embodiments of the disclosure comprise the media packaging and distribution system **102** that may be configured to publish disparate live media output streams to be viewed on a plurality of consumer devices (such as the consumer devices **110***a*, . . . , **110***n*) based on user selection. The media packaging and distribution system **102** may comprise, for example, the DACIS **103**, the CDS **105**, the CPDS **107**, the stream publishing engine **114**, PEM **115**, indexing and storage system **116**, the stream selection service **142**, and the repository of schedules, rights, and user preferences database **144**. In accordance with an embodiment, one or more processors in the DACIS **103** may be configured to receive a first manifest request, comprising one or more parameters, from a first client device, such as client device **132***a*. The one or more processors in the DACIS **103** may be further configured to determine a first additional content comprising a customized first programming content and a targeted first non-programming content for the first client device based on the one or more parameters and associated indexed metadata retrieved based on the one or more parameters. The one or more processors in the DACIS **103** may be further configured to generate the first programming schedule **111**, for the first client device based on selected one or more live input stream and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content. The one or more processors in the DACIS **103** may be further configured to select one or more live input stream manifests and/or one or more pre-encoded media asset manifests published in the content delivery system **130** and associated indexed metadata based on the one or more parameters. The one or more processors in the DACIS **103** may be further configured to publish a first disparate live media output stream manifest for the first client device based on insertion of the selected one or more live input stream manifests and/or the one or more pre-encoded media asset manifests, the associated indexed metadata, and the determined first additional content in accordance with the first programming schedule **111**, generated for the first client device.

In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to index a plurality of media segments indicated by the one or more pre-encoded media asset manifests and the one or more live input stream manifests, the associated indexed metadata, the targeted first non-programming content, and the customized first programming content based on the first programming schedule **111** generated for the first client. In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to insert the first additional content at one or more content placement opportunities indicated in the first disparate live media output stream manifest based on the first programming schedule **111** generated for the first client device. The one or more content placement opportunities may be defined by the metadata associated with the one or more live input streams corresponding to the one or more live input stream manifests and/or one or more pre-encoded media assets corresponding to the one or more pre-encoded media asset manifests. The insertion of the targeted first non-programming content and the customized first programming content in real time, the associated indexed metadata and/or the one or more content placement opportunities may include programming content indicators, non-programming content indicators, graphical treatment indicators, and interactive content indicators.

In accordance with an embodiment, the insertion of the customized first programming content, in an instance in which the generated first disparate live media output stream manifest corresponds to a disparate live media output stream, a first set of processors in the DACIS **103** may be

further configured to receive universal resource locators and/or identifiers referencing records for the selected one or more live input streams and/or the one or more pre-encoded media assets from the CPDS **107**. The associated indexed metadata and/or one or more content placement opportunities may include programming content indicators, non-programming content indicators, graphical treatment indicators, and interactive content indicators. The programming content indicators may comprise a plurality of categories for the customized first programming content.

In accordance with an embodiment, the first set of processors in the DACIS **103** may be further configured to transmit a request to the CDS **105** for determining the customized first programming content from a content package and distribution system for matching one or more personalization parameters. The one or more personalization parameters may include user preferences and identifiers from the first manifest request or retrieved from the repository of schedules, rights, and user preferences database **144**, and time constraints. The time constraints may be determined based on user preferences retrieved from the repository of schedules, rights, and user preferences database **144**, a range defined in the first manifest request, and schedule tolerances defined in the repository of schedules, rights, and user preferences database **144**, client device preferences or identifiers from the first manifest request or retrieved from the repository of schedules, rights, and user preferences database **144**, geolocation information from the first manifest request or retrieved from the repository of schedules, rights, and user preferences database **144**, and/or a content recommendation engine.

In accordance with an embodiment, the one or more parameters may comprise universal resource locators and/or identifiers referencing records for one or more live input streams or one or more pre-encoded media assets in the CPDS **107**, a plurality of client-specific parameters, and a plurality of client-specified attributes derived from a user interaction with the first client device. The plurality of client-specific parameters may comprise user preferences and identifiers, client device preferences and identifiers, and one or more rules governed by geolocation data and current position of playback of a first disparate live media output stream at the first client device. In accordance with an embodiment, for the insertion of the targeted first non-programming content, the plurality of client-specified attributes may comprise the user interaction with interactive content in the customized first programming content and the targeted first non-programming content, and a preference for a type and/or category of the targeted first non-programming content and/or the customized first programming content. The user interaction with the interactive content comprises a selection to exclude the targeted first non-programming content and/or the customized first programming content, a selection to include a subset of the targeted first non-programming content and/or the customized first programming content, and a selection to include all of the targeted first non-programming content and/or the customized first programming content within one or more specified non-programming content locations. The targeted first non-programming content may comprise personalized advertisements including video advertisements, graphical treatment, cue points, and the interactive content comprising a set of interactive elements for the targeted first non-programming content. The customized first programming content may comprise personalized non-advertising content including promotional content, a short-form content, and an alternate additional content for replacement of at least a portion of a first disparate live media output stream generated for the first client.

In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to transmit the published first disparate live media output stream manifest to a media player of the first client device for a playback of a first disparate live media output stream. The media player, during playback of the first disparate live media output stream at the first client device, may present one or more decision points defined by the interactive content to initiate a user interaction at the first client device. At the one or more decision points, the user interaction may correspond to one of a desired selection corresponding to the user interaction with one or more interactive elements, or a default selection corresponding to non-interaction of a user with the customized first programming content and/or the targeted first non-programming content in the first disparate live media output stream played back by the media player. The desired selection or the default selection may be transmitted to an external storage system that is the repository of schedules, rights, and user preferences database **144**. At the one or more decision points, the one or more interactive elements may be configured to exclude the targeted first non-programming content or the customized first programming content and be replaced by default content, select alternate customized first programming content, select a subsequent second programming content, approve or disapprove selected customized first programming content, exclude subsequent second non-programming content for a remaining portion of the first disparate live media output stream played back by the media player, select one or more targeted first non-programming content of a specific category, or view some or all of the targeted first non-programming content immediately to avoid some or all of the targeted first non-programming content for the remaining portion of the first disparate live media output stream played back by the media player.

In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to modify a remaining portion of the first programming schedule **111** that generates first disparate live media output stream corresponding to the first manifest request generated by the first client device based on the user interaction with the interactive content. A first set of processors in the DACIS **103** may be configured to receive the first manifest request from a second set of processors in the DACIS **103**, select, based on the received first manifest request, one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**, and transmit universal resource locators and/or identifiers referencing records for the selected one or more live input streams and/or the one or more pre-encoded media assets to the second set of processors in the DACIS **103**.

In accordance with an embodiment, the second set of processors in the DACIS **103** may be further configured to retrieve the indexed metadata associated with the selected one or more live input streams and/or the one or more pre-encoded media assets from the CPDS **107**. The associated indexed metadata may define one or more content placement opportunities within the selected one or more live input streams and/or the one or more pre-encoded media assets. The customized first programming content and the targeted first non-programming content may be identified as the first additional content to be scheduled at the one or more

content placement opportunities based on the one or more parameters in the received first manifest request and the associated indexed metadata, wherein the generated first programming schedule **111** excludes the first additional content or includes the first additional content completely or partially.

In accordance with an embodiment, a third set of processors in the DACIS **103** may be further configured to insert, based on the generated first programming schedule **111**, the identified customized first programming content and the targeted first non-programming content into the first disparate live media output stream manifest in accordance with the one or more content placement opportunities defined in the associated indexed metadata and one or more rules and conditions defined in the repository of schedules, rights, and user preferences database **144**. The identification of the targeted first non-programming content may be based on execution of a non-programming content service based on rules and conditions defined in additional parameters of the repository of schedules, rights, and user preferences database **144**, and the one or more parameters defined in the first manifest request. The identification of the customized first programming content may be based on execution of the CDS **105** based on the rules and conditions defined in the additional parameters of the repository of schedules, rights, and user preferences database **144**. In accordance with an embodiment, the first programming schedule **111** may define locations and types of one or more decision points defined by one or more content placement opportunities in the indexed metadata. In an instance when one or more pre-encoded media assets are being scheduled and the one or more decision points defined by the one or more content placement opportunities are to be inserted in the first programming schedule **111**, the first programming schedule **111** may be configured to control the one or more pre-encoded media asset manifests to be published as the first disparate live media output stream manifest.

In accordance with an embodiment, a conversion of one or more pre-encoded media assets into a first disparate live media output stream facilitates one or more subsequent modifications on the first disparate live media output stream. The one or more subsequent modifications may correspond to a user selection, a user preference, a change in the first programming schedule **111**, or a time or geolocation-based rule.

In accordance with an embodiment, the first set of processors in the DACIS **103** may be further configured to transmit universal resource locators and/or identifiers referencing records for the selected one or more live input streams and/or the one or more pre-encoded media assets to the second set of processors. In an absence of one or more live input streams, the first set of processors may be configured to select a pre-encoded asset indicated in the first manifest request to continue playback as the first disparate live media output stream. The second set of processors may be configured to select a second disparate live media output stream according to accessibility of the first disparate live media output stream. The first disparate live media output stream is not updated and/or the first disparate live media output stream has media and/or a manifest that is incompatible with a client request. The second set of processors may be further configured to select the second disparate live media output stream according to rules provided by a stream owner/operator and user preferences defined in the repository of schedules, rights, and user preferences database **144**.

In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to transition from the first additional content to an alternate additional content based on one or more transition parameters. The one or more transition parameters may comprise one or more parameters from the first manifest request, current state of the first disparate live media output stream manifest determined based on accessibility, regular update, and suitable encoding, digital rights management, and compatibility with the first client device, rules provided by a stream owner operator, and user preferences defined in the repository of schedules, rights, and user preferences database **144**.

In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to retrieve alternate metadata for the alternate additional content from the CPDS **107**. The alternate metadata may indicate a location to transition from the first additional content to the alternate additional content. The one or more processors may be further configured to determine placement of the alternate additional content within the first disparate live media output stream manifest based on the associated indexed metadata and the alternate metadata. The one or more processors may be further configured to generate the alternate programming schedule **113**, for the first client device based on the alternate additional content and the alternate metadata, and transmit the generated alternate programming schedule to the first set of processors. The first set of processors may be configured to generate a final disparate live output stream manifest for the first client device. In accordance with an embodiment, another conversion of the first disparate live media output stream into the one or more pre-encoded media assets facilitates download of the one or more pre-encoded media assets at the first client device and mitigates dependency on the system for playback of remaining portion. In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to receive a request from the first client device, wherein the request comprises the one or more parameters. The one or more processors in the DACIS **103** may be further configured to determine alternate additional content for inclusion in the first disparate live media output stream manifest or replacement of the first additional content in the first disparate live media output stream manifest based on the one or more parameters. The one or more processors in the DACIS **103** may be further configured to modify the first programming schedule **111** to generate an alternate programming schedule for the first client device based on the alternate additional content and associated metadata. The one or more processors in the DACIS **103** may be further configured to transmit the generated alternate programming schedule to a second set of processors, wherein the second set of processors is configured to generate a final disparate live output stream manifest for the first client device.

In accordance with an embodiment, the one or more processors in the DACIS **103** may be further configured to revoke the first disparate live media output stream manifest published for the first client device based on an identifier primitive associated with the first disparate live media output stream of the first client device in an instance in which a media player of the first client device is determined to be a plagiarized media player. The first disparate live media output stream may include at least one unique identifier inserted by the one or more processors in the DACIS **103**.

In accordance with various embodiments, the first disparate live media output stream manifest for the first client device may be generated based on one of a pre-defined conversion modes. The pre-defined conversion modes may

correspond to pre-encoded media assets to live stream mode, pre-encoded media assets to live stream mode with scalable architecture, a live stream to live stream mode, and a mixed mode corresponding to switching between pre-encoded media assets and live streams.

In accordance with an embodiment, one or more processors in the PEM **115** may be configured to receive a first manifest request, comprising one or more parameters, from the first client device. Further, the received first manifest request may be transmitted to a first set of processors in the stream selection service **142**. The first set of processors may be configured to select, based on the received first manifest request, one or more live input streams and/or one or more pre-encoded media assets based on the one or more parameters and additional parameters retrieved from the repository of schedules, rights, and user preferences database **144**. The one or more processors in the PEM **115** may be configured to receive universal resource locators and/or identifiers referencing records for the selected one or more live input streams and/or the one or more pre-encoded media assets from the first set of processors. The one or more processors in the PEM **115** may be configured to retrieve indexed metadata associated with the selected one or more live input streams and/or the one or more pre-encoded media assets from a content packaging and distribution system, wherein the indexed metadata defines one or more content placement opportunities within the selected one or more live input streams and/or the one or more pre-encoded media assets. The one or more processors in the PEM **115** may be further configured to identify a customized first programming content and a targeted first non-programming content as a first additional content to be scheduled in the one or more content placement opportunities based on the one or more parameters in the received first manifest and the associated indexed metadata. The one or more processors in the PEM **115** may be further configured to generate the first programming schedule **111** for the first client device based on the associated indexed metadata, the first additional content and the one or more live input streams and/or one or more pre-encoded media assets.

Various embodiments of the disclosure comprise the media packaging and distribution system **102** that may be configured to manage a pre-encoded media asset for immediate playback. The media packaging and distribution system **102** may comprise one or more processors, for example, the CDS **105**, the CPDS **107**, the content encoder/packager **107***a*, the content metadata store **107***b*, the SSAI system **109**, the internal manifest index **109***a*, and the repository of schedules, rights, and user preferences database **144**. The one or more processors in the media packaging and distribution system **102** may be implemented in conjunction with the Ad decisioning servers **106***a*, . . . , **106***n*, the external data source **120**, the content delivery system **130**, and the client devices **132***a*, . . . , **132***n*. In accordance with an embodiment, one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to generate, based on a receipt of an initial manifest request from a first client device, such as the client device **132***a*, an initial pre-encoded media asset manifest that comprises an initial set of programming content segments. The one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be further configured to communicate the generated initial pre-encoded media asset manifest, as a first disparate live media output stream manifest, to a media player of the first client device, such as the client device **132***a*, via a content delivery system, such as the content delivery system **130**, for an immediate playback of a pre-encoded media asset, such as the first pre-encoded media asset **602**, the second pre-encoded media asset **612**, and the third pre-encoded media asset **622**. The one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be further configured to assign a unique SID to the first client device, such as the client device **132***a*, to record a session of the first client device for a subsequent manifest request or a final manifest request associated with the initial manifest request. The one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be further configured to generate a final pre-encoded media asset manifest, such as Manifest **3** as illustrated in both the use cases of the first exemplary scenario **600**A, the second exemplary scenario **600**B, the third exemplary scenario **600**C, upon a receipt of the subsequent manifest request from the first client device, such as the client device **132***a*, based on a defined criterion. The final pre-encoded media asset manifest may comprise remaining programming content segments corresponding to the pre-encoded media asset, non-scheduled programming content segments corresponding to each non-scheduled programming content, and non-programming content segments corresponding to each non-programming content based on targeting and/or non-targeting parameters.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the content encoder/packager **107***a*, may be configured to generate the pre-encoded media asset comprising a plurality of programming content segments for the distribution. The one or more processors in the media packaging and distribution system **102**, such as the content encoder/packager **107***a*, may be further configured to adjust, based on metadata retrieved from a content metadata store, such as the content metadata store **107***b*, the plurality of programming content segments in the pre-encoded media asset. The adjustment of the plurality of programming content segments may provide a first set of content placement opportunities where the non-scheduled programming content and/or the non-programming content are inserted in a pre-encoded media asset manifest. The adjustment of the plurality of programming content segments may provide a second set of content placement opportunities where event-based programming content occurs in the pre-encoded media asset manifest. The first set of content placement opportunities may correspond to programming indicators and non-programming indicators and the second set of content placement opportunities correspond to event markers. The non-scheduled programming content may correspond to additional content provided by a content decision server, the non-programming content may correspond to advertisement breaks or promotional content provided by an advertisement decision server, and the event-based programming content may correspond to an identifier corresponding to an event related to content of the pre-encoded media asset

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the content encoder/packager **107***a*, may be configured to store timestamps of the first set of content placement opportunities and the second set of content placement opportunities in the metadata upon the generation of the pre-encoded media asset.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the content encoder/packager **107***a*, may be configured to mark a start location and an end location of each of the first set of content placement opportunities and

the second set of content placement opportunities in the pre-encoded media asset manifest.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to receive an initial manifest request from the first client device, such as the client device **132***a*, to view the pre-encoded media asset. In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102** may be configured to access the pre-encoded media asset manifest, based on the received initial manifest request, from a content delivery system, such as the content delivery system **130**, or an internal manifest index, such as the internal manifest index **109***a*. Exemplary targeting and non-targeting parameters may include, but are not limited to, metadata associated with the pre-encoded media asset, data associated with the first client device, such as the client device **132***a*, and/or data associated with a scheduling window of the pre-encoded media asset.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to, based on the targeting and/or non-targeting parameters, an external system, and/or a set of pre-determined rules, insert each non-scheduled programming content and/or non-programming content in the pre-encoded media asset manifest as an initial and final response to the initial manifest request for playback of the pre-encoded media asset at the first client device, such as the client device **132***a*, in accordance with a first instruction. In accordance with an embodiment, the initial pre-encoded media asset manifest may be independent of the non-scheduled programming content and/or the non-programming content. In accordance with an embodiment, the initial pre-encoded media asset manifest may be based on the targeting and/or non-targeting parameters, an external system, and/or a set of pre-determined rules. In accordance with an embodiment, the initial pre-encoded media asset manifest may enable the immediate playback of the pre-encoded media asset at the first client device in accordance with a second instruction.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to determine a capability of the first client device, such as the client device **132***a*, based on the targeting and/or non-targeting parameters, the external system and/or the set of pre-determined rules. The capability of the first client device, such as the client device **132***a*, corresponds to an extent of player integration with the system and compatibility of the first client device, such as the client device **132***a*, with a required protocol.

In accordance with an embodiment, in case the extent of the player integration with the system is limited and the first client device, such as the client device **132***a*, is incompatible with the required protocol, size of the initial set of programming content segments is verified to be equal to a capacity of a playback buffer in the media player of the first client device, such as the client device **132***a*. The equality between the size of the initial set of programming content segments and the capacity of the playback buffer facilitates the immediate playback at the first client device, such as the client device **132***a*, from beginning of the pre-encoded media asset.

In accordance with an embodiment, in case the extent of the player integration with the system is complete and the first client device, such as the client device **132***a*, is compatible with the required protocol, the initial pre-encoded media asset manifest may comprise the initial set of programming content segments up to a first content placement opportunity from the first set of content placement opportunities marked for insertion of a first non-scheduled programming content and/or non-programming content. In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to communicate a signal to the media player of the first client device, such as the client device **132***a*, to start the immediate playback from beginning of the pre-encoded media asset. In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to control a timing of the subsequent manifest request to be generated by the media player of the first client device, such as the client device **132***a*. In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to provide data indicating a duration of the pre-encoded media asset to the media player of the first client device, such as the client device **132***a*.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to designate the initial pre-encoded media asset manifest to inform the media player of the first client device, such as the client device **132***a*, to generate the subsequent manifest request.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to verify receipt of information regarding each of the non-scheduled programming content and/or the non-programming content from corresponding servers, such as the CDS **105** and the Ad decisioning servers **106***a*, . . . , **106***n*. The one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to determine whether insertion of each of the non-scheduled programming content and/or the non-programming content is complete or incomplete in an updated pre-encoded media asset manifest based on the received information.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to communicate the final pre-encoded media asset manifest to the first client device, such as the client device **132***a*, in response to the subsequent manifest request when the defined criterion is met. The defined criterion may correspond to the determination that the insertion of the non-scheduled programming content and/or the non-programming content in the final pre-encoded media asset manifest is complete. The final pre-encoded media asset manifest may include references to the set of non-scheduled programming content segments and/or non-programming content segments corresponding to each non-scheduled programming content and/or non-programming content respectively, inserted at a first set of content placement opportunities defined in metadata. In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to designate the final pre-encoded media asset manifest to inform the media player of the first client device, such as the client device **132***a*, to cease further generation of the subsequent manifest request.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to communicate the updated pre-encoded media asset manifest to the first client device, such as the client device **132***a*, in response to an updated manifest request. The updated pre-encoded media asset manifest may be generated when the insertion of the non-scheduled programming content and/or the non-programming content is determined to be incomplete. In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to designate the updated pre-encoded media asset manifest to inform the media player of the first client device, such as the client device **132***a*, to generate the subsequent manifest request or the final manifest request.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to add additional content segments corresponding to the pre-encoded media asset, non-scheduled programming content segments and/or non-programming content segments in the updated pre-encoded media asset manifest to provide additional time duration. In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to complete, in the additional time duration, the insertion of the non-scheduled programming content and/or the non-programming content in the updated pre-encoded media asset manifest at a portion of or an entire first set of content placement opportunities defined in metadata when the pre-encoded media asset manifest and/or the metadata does not include a second set of content placement opportunities where event-based programming content occurs in the pre-encoded media asset manifest.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to add a plurality of event-based programming content segments and additional content segments in the updated pre-encoded media asset manifest when the pre-encoded media asset manifest and/or metadata includes a second set of content placement opportunities where event-based programming content occurs in the pre-encoded media asset manifest. The size of the additional content segments may match with capacity of a playback buffer in the media player of the first client device, such as the client device **132***a*.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to allow the media player of the first client device, such as the client device **132***a*, to begin the immediate playback after a marked end location of the plurality of event-based programming content segments upon receipt of an input from the first client device, such as the client device **132***a*, to skip the event-based programming content. The immediate playback starts from a beginning of the additional content segments in the updated pre-encoded media asset manifest.

In accordance with an embodiment, the one or more processors in the media packaging and distribution system **102**, such as the SSAI system **109**, may be configured to store the initial, the updated, and/or the final pre-encoded media asset manifests as a set of asset manifests corresponding to the unique SID for a designated period of time when the receipt of the information regarding each of the non-scheduled programming content and/or the non-programming content is verified, the insertion of each of the non-scheduled programming content and/or the non-programming content is determined to be complete, and the final pre-encoded media asset manifest is communicated to the first client device, such as the client device **132***a*. The set of asset manifests is stored based on duration of the pre-encoded media asset upon receipt of a request of a different profile from the media player of the first client device, such as the client device **132***a*, based on connectivity changes of the first client device.

In accordance with an embodiment, the initial pre-encoded media asset manifest may be communicated as the first disparate live media output stream manifest to the first client device, such as the client device **132***a*, based on one of a pre-defined conversion modes. The pre-defined conversion modes correspond to a pre-encoded media assets to live stream mode or a pre-encoded media assets to live stream mode with scalable architecture. The conversion facilitates a subsequent modification to the first disparate live media output stream. The subsequent modification corresponds to one of a user selection, a user preference, or a change in a time or geolocation-based rule.

Various embodiments of the disclosure may provide a computer-readable medium, such as the non-transitory computer-readable medium **506**, having stored thereon, computer implemented instruction that when executed by the processor **504** causes the media packaging and distribution system **102** to execute operations for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content. In accordance with an embodiment, the processor **504** causes the media packaging and distribution system **102** to execute operations to receive a first manifest request, comprising one or more parameters, from a first client device, such as client device **132***a*. The processor **504** causes the media packaging and distribution system **102** to execute operations to determine a first additional content comprising a customized first programming content and a targeted first non-programming content for the first client device based on the one or more parameters and associated indexed metadata retrieved based on the one or more parameters. The processor **504** causes the media packaging and distribution system **102** to execute operations to generate the first programming schedule **111**, for the first client device based on selected one or more live input stream and/or the one or more pre-encoded media assets, the associated indexed metadata, and the determined first additional content. The processor **504** causes the media packaging and distribution system **102** to execute operations to select one or more live input stream manifests and/or one or more pre-encoded media asset manifests published in the content delivery system **130** and associated indexed metadata based on the one or more parameters. The processor **504** causes the media packaging and distribution system **102** to execute operations to publish a first disparate live media output stream manifest for the first client device based on insertion of the selected one or more live input stream manifests and/or the one or more pre-encoded media asset manifests, the associated indexed metadata, and the determined first additional content in accordance with the first programming schedule **111**, generated for the first client device.

Various embodiments of the disclosure may provide a computer-readable medium, such as the non-transitory computer-readable medium **556**, having stored thereon, computer implemented instruction that when executed by the processor **554** causes the media packaging and distribution system **102** to execute operations for managing a pre-

encoded media asset for immediate playback. In accordance with an embodiment, the processor **554** causes the media packaging and distribution system **102** to execute operations to generate, based on a receipt of an initial manifest request from a first client device, an initial pre-encoded media asset manifest that comprises an initial set of programming content segments. The processor **554** further causes the media packaging and distribution system **102** to execute operations to communicate the generated initial pre-encoded media asset manifest, as a first disparate live media output stream manifest, to a media player of the first client device, such as the client device **132***a*, via a content delivery system, such as the content delivery system **130**, for an immediate playback of a pre-encoded media asset, such as the first pre-encoded media asset **602**, the second pre-encoded media asset **612**, and the third pre-encoded media asset **622**. The processor **554** further causes the media packaging and distribution system **102** to execute operations to assign a unique SID to the first client device, such as the client device **132***a*, to record a session of the first client device for a subsequent manifest request or a final manifest request associated with the initial manifest request. The processor **554** further causes the media packaging and distribution system **102** to execute operations to generate a final pre-encoded media asset manifest, such as Manifest **3** as illustrated in both the use cases of the first exemplary scenario **600**A, the second exemplary scenario **600**B, the third exemplary scenario **600**C, upon a receipt of the subsequent manifest request from the first client device, such as the client device **132***a*, based on a defined criterion. The final pre-encoded media asset manifest may comprise remaining programming content segments corresponding to the pre-encoded media asset, non-scheduled programming content segments corresponding to each non-scheduled programming content, and non-programming content segments corresponding to each non-programming content based on targeting and/or non-targeting parameters.

Existing systems for SSAI support live streaming and make decisions to insert non-programing content in near real-time. However, for On-Demand streaming, such decisions to insert non-programing content are made upfront. Accordingly, amount of control the user can excerpt to influence what non-programming content is shown may get limited. Further, newer ad models are developing that rely less on interruptive video advertising and more on contextual based graphical treatment advertising within the program content. To this extent, SSAI systems have been able to circumvent ad blockers by requesting video ads on behalf of the client device and stitching them into the disparate live media output stream manifest.

To address at least the above problems, in accordance with the various embodiments of the present disclosure, the DACIS **103** in the media packaging and distribution system **102** may be configured to include not showing non-programming content that the user elected to skip or rated poorly in an earlier non-programming content break, or could enable the user to skip all non-programming content because the user interacted with an previous non-programming content or made a purchase and the advertiser elected to sponsor the remainder of the program.

The DACIS **103** may notified about graphical treatment opportunities within the content, make the necessary ad calls on behalf of the client device, and provide the client device with the information needed to execute the overlays via a secure out-of-band channel between the DACIS **103** and the client device. In many cases, a channel already exists to support passing the program indicators, such as start and end information, to the client device and Video Player Ad-Serving Interface (VPAID) ads that cannot be stitched.

DACIS **103** may also provide an opportunity to leverage the 1:1 scale of traditional SSAI systems to support custom content choices and not just targeted advertising. For example, when a user selects to join a live stream, the CDS **105** coupled with the DACIS **103** may determine that, instead of joining the live stream for the last few minutes of a program, the user should instead be shown content more relevant to the next program. For example, showing a personalized set of basketball highlights and ads to a user who likely joined the stream to watch the basketball game that is coming on next.

Further, the DACIS **103** may be used to provide seamless failover between redundant streams for large events, thus improving reliability. While some client devices support primary and backup streams and are able to fail between them, many client devices do not. In such cases, the client device may attempt to join the alternative stream after occurrence of an event, such as a device failure or crash. For such clients, the DACIS **103** monitors both the primary and backup stream, and if there is a failure, inserts the alternative stream into the output manifest. Thus, the media packaging and distribution system **102** provides an enhanced, intelligent, and personalized viewer experience with increased appeal in order to retain and gain a wider audience.

The DACIS **103**, the CDS **105**, the CPDS **107**, the stream publishing engine **114**, PEM **115**, indexing and storage system **116**, the stream selection service **142**, and the repository of schedules, rights, and user preferences database **144** in conjunction with each other, provide significant productivity and efficiency improvements since the process of generating disparate live media output streams with additional content is specific to each consumer device. The disparate live media output streams are simplified as the generated disparate live media output streams are independent of a requirement to re-process, that is re-encode and re-package, various live input streams for media distribution to the plurality of consumer devices in real time or near-real time. Thus, the network provider now may provide live channel offerings in a cost-effective manner.

Various components, as described above in FIG. **1**B, enable the media packaging and distribution system **102** to leverage the modern streaming protocols, based on which the media packaging and distribution system **102** generates disparate live media output streams of the live broadcast channels with additional content and one or more decision points to influence the remaining disparate live media output streams. The disparate live media output streams may be generated based on insertion of live input streams into a generated disparate live media output stream using pre-encoded media assets. In this regard, manifests from the live input streams and the pre-encoded media assets may be manipulated and produced for distribution of the disparate live media output stream.

As the media content itself does not need to be processed beyond the initial creation of the live input streams and pre-encoded media assets prepared for distribution, it is extremely inexpensive to provide such disparate live media output streams and alternate disparate live media output stream (in case of stream failover). It may be based solely on the cost to manipulate the manifests, which provide the instructions for the media players in the client devices **132***a*, . . . , **132***n* to execute. The media packaging and distribution system **102** may also support targeted ad insertion and customized programming content insertion on a per client basis and may further leverage the processing power

of the individual client devices **132***a*, . . . , **132***n* to insert targeted channel graphics and graphical treatment advertisements and promotions.

Various other components, as described above in FIG. **1**D, may enable the media packaging and distribution system **102** to leverage the salient features of modern web streaming protocols and capabilities of the media players in client devices to manage corresponding video buffers in such a manner that the media players are allowed to access the first segment of the pre-encoded media asset, such as VOD asset, in minimal time for immediate playback. At the same time, for the whole duration of the pre-encoded media asset, the media packaging and distribution system **102** does not introduce the cost of sustaining (or maintaining) a client session. Thus, the proposed system and method in the media packaging and distribution system **102** is high on cost saving as compared to existing systems and methods and provides a seamless viewer experience by mitigating the delay in delivering the asset manifest of the pre-encoded media asset to the media players. It also simplifies the user experience by supporting trick play modes with given extent of player-SSAI system integration.

More specifically, to ensure a smooth video playback of the pre-encoded media asset, the client device downloads and buffers a few video segments (typically 3) before the video playback. For an older client device that extends limited SSAI integration and is incompatible with required protocols, an initial pre-encoded media asset manifest may be generated with the number of segments equivalent to the video buffer. While the client device downloads such segments and begins playback, ads may be inserted in the remaining manifest. When the client device requests an updated manifest, the entire playlist stitched with ads may be provided in response, if all the ads are inserted. If the ads are still being inserted, additional segments may be added to the updated manifest and returned to the client device. Upon the subsequent manifest request for the updated manifest, the entire playlist stitched with ads may be returned. The advantage of the proposed approach is that the client session is typically less than 30 seconds, versus the duration of the VOD asset. Further, trick mode control by the client device may be enabled as soon as the entire manifest is delivered, without the need for complex player integration.

Further, enabling the viewer's capability to skip previous episode recaps and opening credits may also be maintained, with additional intelligence and knowledge of the SSAI system **109** about how such events are identified. A manifest inclusive of the event-based programming segments of the skippable portion of the content along with the additional content segments equivalent to the video buffer of the media player may be returned, in response to the media player request after the playback is started.

As utilized herein the terms "circuits" and "circuitry" refer to physical electronic components (for example, hardware) and any software and/or firmware ("code") which may configure the hardware, be executed by the hardware, and/or otherwise be associated with the hardware. As used herein, for example, a particular processor and memory may comprise a first "circuit" when executing first one or more lines of code and may comprise a second "circuit" when executing second one or more lines of code. As utilized herein, "and/or" means any one or more of the items in the list joined by "and/or". As an example, "x and/or y" means any element of the three-element set {(x), (y), (x, y)}. As another example, "x, y, and/or z" means any element of the seven-element set {(x), (y), (z), (x, y), (x, z), (y, z), (x, y, z)}. As utilized herein, the term "exemplary" means serving as a non-limiting example, instance, or illustration. As utilized herein, the terms "e.g.," and "for example" set off lists of one or more non-limiting examples, instances, or illustrations. As utilized herein, circuitry is "operable" to perform a function whenever the circuitry comprises the necessary hardware and/or code (if any is necessary) to perform the function, regardless of whether performance of the function is disabled, or not enabled, by some user-configurable setting.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of embodiments of the disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises", "comprising", "includes" and/or "including", when used herein, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Further, many embodiments are described in terms of sequences of actions to be performed by, for example, elements of a computing device. It will be recognized that various actions described herein can be performed by specific circuits (e.g., application specific integrated circuits (ASICs)), by program instructions being executed by one or more processors, or by a combination of both. Additionally, these sequences of actions described herein can be considered to be embodied entirely within any non-transitory form of computer readable storage medium having stored therein a corresponding set of computer instructions that upon execution would cause an associated processor to perform the functionality described herein. Thus, the various aspects of the disclosure may be embodied in a number of different forms, which have been contemplated to be within the scope of the claimed subject matter. In addition, for each of the embodiments described herein, the corresponding form of any such embodiments may be described herein as, for example, "logic configured to" perform the described action.

Another embodiment of the disclosure may provide a non-transitory machine and/or computer readable storage and/or media, having stored thereon, a machine code and/or a computer program having at least one code section executable by a machine and/or a computer, thereby causing the machine and/or computer to perform the steps as described herein for publishing a disparate per-client live media output stream based on dynamic insertion of targeted non-programming content and customized programming content, and for managing a pre-encoded media asset for immediate playback.

The present disclosure may also be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, either statically or dynamically defined, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

Further, those of skill in the art will appreciate that the various illustrative logical blocks, modules, circuits, algorithms, and/or steps described in connection with the embodiments disclosed herein may be implemented as elec-

tronic hardware, computer software, firmware, or combinations thereof. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

The methods, sequences and/or algorithms described in connection with the embodiments disclosed herein may be embodied directly in firmware, hardware, in a software module executed by a processor, or in a combination thereof. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, physical and/or virtual disk, a removable disk, a CD-ROM, virtualized system or device such as a virtual servers or container, or any other form of storage medium known in the art. An exemplary storage medium is communicatively coupled to the processor (including logic/code executing in the processor) such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor.

While the present disclosure has been described with reference to certain embodiments, it will be noted understood by, for example, those skilled in the art that various changes and modifications could be made and equivalents may be substituted without departing from the scope of the present disclosure as defined, for example, in the appended claims. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from its scope. The functions, steps and/or actions of the method claims in accordance with the embodiments of the disclosure described herein need not be performed in any particular order. Furthermore, although elements of the disclosure may be described or claimed in the singular, the plural is contemplated unless limitation to the singular is explicitly stated. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed, but that the present disclosure will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A system comprising memory and one or more processors communicatively coupled to the memory, the one or more processors configured to:

receive an initial manifest request from a client device, wherein the initial manifest request identifies a playback buffer size of the client device;

determine a size of an initial set of programming content segments based on the playback buffer size;

generate an initial pre-encoded media asset manifest that references the initial set of programming content segments; and

transmit, to a content delivery system, the initial pre-encoded media asset manifest, wherein, based on the transmission, the content delivery system streams an output stream associated with the initial pre-encoded media asset manifest to the client device.

2. The system according to claim **1**, wherein the one or more processors are further configured to:

generate a pre-encoded media asset comprising a plurality of programming content segments; and

adjust, based on metadata retrieved from a content metadata store, the plurality of programming content segments in the pre-encoded media asset,

wherein the adjustment of the plurality of programming content segments provides a first set of content placement opportunities wherein at least one of non-scheduled programming content or non-programming content are inserted in a pre-encoded media asset manifest,

wherein the adjustment of the plurality of programming content segments provides a second set of content placement opportunities indicating where event-based programming content occurs in the initial pre-encoded media asset manifest,

wherein the first set of content placement opportunities correspond to programming indicators and non-programming indicators and the second set of content placement opportunities correspond to event markers, and

wherein the non-scheduled programming content corresponds to additional content provided by a content decision server, the non-programming content corresponds to advertisement breaks or promotional content provided by an advertisement decision server, and the event-based programming content corresponds to an identifier corresponding to an event related to content of the pre-encoded media asset.

3. The system according to claim **2**, wherein the one or more processors are further configured to:

store timestamps of the first set of content placement opportunities and the second set of content placement opportunities in the metadata upon the generation of the pre-encoded media asset.

4. The system according to claim **2**, wherein the one or more processors are further configured to:

mark a start location and an end location of each of the first set of content placement opportunities and the second set of content placement opportunities in the initial pre-encoded media asset manifest.

5. The system according to claim **1**, wherein the one or more processors are further configured to:

assign a unique session identifier (SID) to the client device to record a session of the client device for a subsequent manifest request or a second manifest request associated with the initial manifest request;

receive a subsequent manifest request associated with the unique SID; and

in response to the subsequent manifest request, generate a second pre-encoded media asset manifest based on a defined criterion, wherein the second pre-encoded media asset manifest refers to remaining programming content segments corresponding to a pre-encoded media asset, non-scheduled programming content segments corresponding to non-scheduled programming content, and non-programming content segments corresponding to non-programming content.

6. The system according to claim **5**, wherein the one or more processors are further configured to:

receiving the initial manifest request from the client device to view the pre-encoded media asset; and

accessing the initial pre-encoded media asset manifest, based on the initial manifest request, from the content delivery system or an internal manifest index, wherein the remaining programming content segments are referenced by the second pre-encoded media asset manifest based on parameters comprise metadata associated with the pre-encoded media asset, data associated with

at least one of the client device, or data associated with scheduling window of the pre-encoded media asset.

7. The system according to claim 5, wherein the remaining programming content segments are referenced by the second pre-encoded media asset manifest based on at least one of parameters, an external system, or a set of pre-determined rules, and the one or more processors are further configured to:

insert at least one of non-scheduled programming content or non-programming content in the initial pre-encoded media asset manifest as an initial and second response to the initial manifest request for playback of the pre-encoded media asset at the first client device in accordance with a first instruction.

8. The system according to claim 5, wherein:

(i) the initial pre-encoded media asset manifest is independent of at least one of non-scheduled programming content or the non-programming content,

(ii) the initial pre-encoded media asset manifest is based on at least one of parameters, an external system, or a set of pre-determined rules,

(iii) the initial pre-encoded media asset manifest enables playback of the pre-encoded media asset at the client device in accordance with a second instruction, and

the one or more processors are further configured to:

determine a capability of the client device based on at least one of the parameters, the external system or the set of pre-determined rules,

wherein the capability of the client device corresponds to an extent of player integration with the system and compatibility of the first client device with a required protocol.

9. The system according to claim 8, wherein, in a circumstance in which the extent of the player integration with the system is complete and the first client device is compatible with the required protocol, the initial pre-encoded media asset manifest refers to the initial set of programming content segments up to a first content placement opportunity from a first set of content placement opportunities marked for insertion of at least one of a first non-scheduled programming content or the non-programming content, wherein the one or more processors are further configured to:

communicate a signal to the client device to start the playback from beginning of the pre-encoded media asset;

control a timing of the subsequent manifest request to be generated by the client device; and

provide data indicating a duration of the pre-encoded media asset to the client device.

10. The system according to claim 9, wherein the one or more processors are further configured to:

designate the initial pre-encoded media asset manifest to inform the client device to generate the subsequent manifest request.

11. The system according to claim 5, wherein the one or more processors are further configured to:

verify receipt of information regarding each of at least one of the non-scheduled programming content or the non-programming content from corresponding servers; and

determine whether insertion of each of the at least one of the non-scheduled programming content or the non-programming content is complete or incomplete in an updated pre-encoded media asset manifest based on the information.

12. The system according to claim 11, wherein the one or more processors are further configured to:

communicate the second pre-encoded media asset manifest to the client device in response to a second manifest request when the defined criterion is met, wherein the defined criterion corresponds to the determination that the insertion of at least one of the non-scheduled programming content or the non-programming content in the second pre-encoded media asset manifest is complete,

wherein the second pre-encoded media asset manifest includes references to at least one of: (a) the non-scheduled programming content segments, (b) non-programming content segments corresponding to each non-scheduled programming content, or (c) non-programming content, inserted at a first set of content placement opportunities defined in metadata; and

designate the second pre-encoded media asset manifest to inform the client device to cease further generation of the second manifest request.

13. The system according to claim 11, wherein the one or more processors are further configured to:

communicate an updated pre-encoded media asset manifest to the client device in response to an updated manifest request, wherein the updated pre-encoded media asset manifest is generated when the insertion of at least one of the non-scheduled programming content or the non-programming content is determined to be incomplete; and

designate the updated pre-encoded media asset manifest to inform the client device to generate the subsequent manifest request.

14. The system according to claim 13, wherein the one or more processors are further configured to:

add additional content segments corresponding to at least one of the pre-encoded media asset, non-scheduled programming content segments or non-programming content segments in the updated pre-encoded media asset manifest to provide additional time duration; and

complete, in the additional time duration, the insertion of at least one of the non-scheduled programming content, or the non-programming content in the updated pre-encoded media asset manifest at a portion of or an entire first set of content placement opportunities defined in metadata when at least one of the initial pre-encoded media asset manifest or the metadata does not include a second set of content placement opportunities.

15. The system according to claim 13, wherein the one or more processors are further configured to:

add a plurality of event-based programming content segments and additional content segments in the updated pre-encoded media asset manifest in a circumstance in which at least one of the initial pre-encoded media asset manifest or metadata includes a second set of content placement opportunities,

wherein a size of the additional content segments satisfies a capacity of a playback buffer of the client device; and

allow the client device to begin playback after a marked end location of the plurality of event-based programming content segments upon receipt of an input from the client device to skip event-based programming content segments, wherein the playback starts from a beginning of the additional content segments in the updated pre-encoded media asset manifest.

16. The system according to claim 13, wherein the one or more processors are further configured to:

store at least one of the initial pre-encoded media asset manifest, the updated pre-encoded media asset manifest, or the second pre-encoded media asset manifest as a set of asset manifests corresponding to a unique session identifier (SID) for a designated period of time in a circumstance in which (a) the receipt of the information regarding each of at least one the non-scheduled programming content or the non-programming content is verified, (b) the insertion of at least one of the non-scheduled programming content or the non-programming content is determined to be complete, and (c) the second pre-encoded media asset manifest is communicated to the client device,

wherein the set of asset manifests is stored based on duration of the pre-encoded media asset upon receipt of a request of a different profile from the client device based on connectivity changes of the client device.

17. The system according to claim 1, wherein the initial pre-encoded media asset manifest is communicated to the client device based on one of a pre-defined conversion modes,

wherein the pre-defined conversion modes correspond to a pre-encoded media assets to live stream mode or a pre-encoded media assets to live stream mode with scalable architecture, wherein conversion facilitates a subsequent modification, and

wherein the subsequent modification corresponds to at least one of a user selection, a user preference, or a change in a time or geolocation-based rule.

18. A method, comprising:

receiving an initial manifest request from a client device, wherein the initial manifest request identifies a playback buffer size of the client device;

determining a size of an initial set of programming content segments based on the playback buffer size;

generating an initial pre-encoded media asset manifest that references the initial set of programming content segments; and

transmitting, to a content delivery system, the initial pre-encoded media asset manifest, wherein, based on the transmission, the content delivery system streams an output stream associated with the initial pre-encoded media asset manifest to the client device.

19. A computer program product comprising at least one non-transitory computer-readable storage medium having computer-executable program code instructions stored therein, the computer-executable program code instructions comprising program code instructions to:

receive an initial manifest request from a client device, wherein the initial manifest request identifies a playback buffer size of the client device;

determine a size of an initial set of programming content segments based on the playback buffer size;

generate an initial pre-encoded media asset manifest that references the initial set of programming content segments; and

transmit, to a content delivery system, the initial pre-encoded media asset manifest, wherein, based on the transmission, the content delivery system streams an output stream associated with the initial pre-encoded media asset manifest to the client device.

* * * * *