P2P Live Streaming for the masses – Deployment and Results

July 28th, 2009

Background and discussions points

- ➢ RayV deployed system
- ➢ The content owners' wish list
- ➢ How does P2P live streaming improve viewing quality
- ➢ Scale and the upload problem
- ➢ P2P live streaming deployment costs
- ➢ Content Owners and Operators - Rules

P2P live streaming for content owners

Analysis based on a system using a hybrid P2P and own CDN with:

➢ 3 million downloads
➢ On average 300,000 connected clients
➢ 70,000 concurrent viewers at peak

Watching habits results ("just like TV"):

➢ Overall: 31 minutes/day
➢ Sports: 36.7 minutes a session, 98 minutes a day
➢ News: 12 minutes a session
➢ Music: 5 minutes a session

Content owners requirements

- **Quality and bit-rate** *(does P2P streaming help here???)*
  - 300Kbps (for UGC channels and specific limitations)
  - 500-800Kbps for news/music channels
  - 800-1.5Mbps for sports.
  - 2.5Mbps to 6Mbps for upcoming TV-like experience
- **Delay** *(can this be achieved with P2P streaming???)*
  - Broadcaster to viewers up to 10 seconds
  - Simultaneous viewing up to 2 seconds

  Is this possible with P2P streaming???
- **Low cost streaming** *(how much P2P streaming saves???)*
  - Advertising model
  - Subscription model

  How much P2P streaming saves???
- **Scale of concurrent viewers** *(does P2P scale better???)*
  - Misconception of scale
  - Global distribution

  Does P2P help here???
- **Rules** *(P2P limitations)*
  - Content owners
  - ,Operators
  - Legal

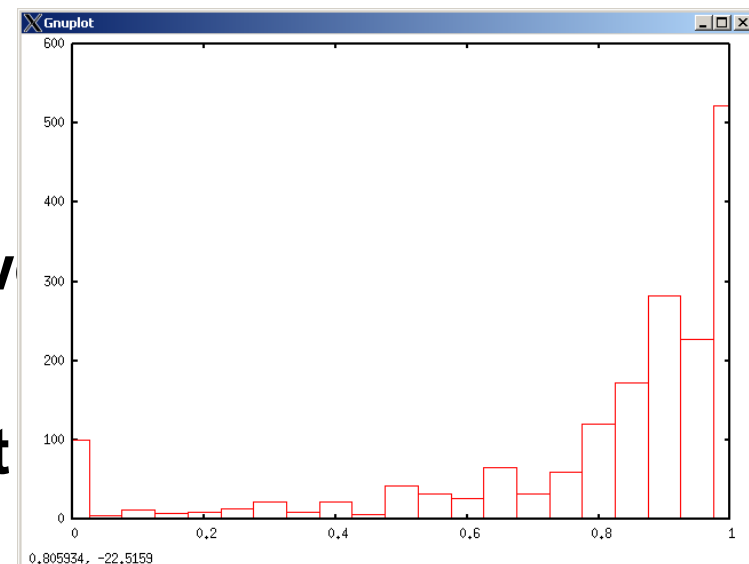# Network quality and geo-localization needs

Result analysis by:

- ➢ **Viewing quality averages by country**
- ➢ **Viewing quality deviation graph**

The results are based on a system using a TCP congestion control over UDP (SCTP) no retransmission on higher level.
Buffer of 5 seconds in both cases. No P2P system still uses more than one reliable source.

Deviation results:

When 0% p2p we see many view
around 0.85-0.90.

With 70% p2p the graph on right

Network quality and geo-localization needs

No P2P = Avg 86.5%

0: 'Philippines'	65.30%
1: 'Brazil'	67.24%
2: 'Israel'	73.42%
3: 'Russian Federation'	76.15%
4: 'Japan'	76.38%
5: 'Australia'	80.23%
6: 'Mexico'	80.88%
7: 'None'	81.72%
8: 'United Kingdom'	84.57%
9: 'Spain'	89.15%
0: 'Korea'	91.87%
11: 'Italy'	93.51%
12: 'Norway'	95.12%
13: 'Germany'	95.87%
14: 'Denmark'	97.11%
15: 'Sweeden'	97.34%
16: 'France'	99.10%
17: 'Finland'	99.30%
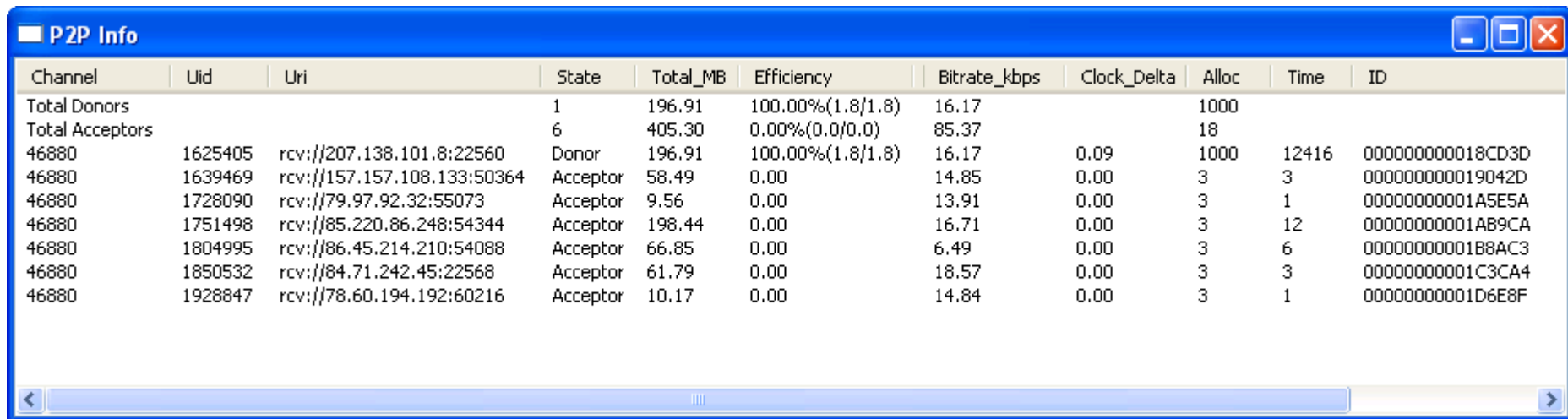
75% P2P = Avg 98.8%

0: 'Thailand'	18.31%		23: 'Georgia'	98.55%
1: 'Guatemala'	84.43%		24: 'United States'	98.57%
2: None	87.50%		25: 'Croatia'	98.91%
3: 'Netherlands'	91.58%		26: 'Luxembourg'	98.98%
4: 'Mexico'	91.89%		27: 'Singapore'	98.99%
5: 'Estonia'	93.62%		28: 'Ireland'	99.06%
6: 'Israel'	94.50%		29: 'Russian Federation'	99.16%
7: 'Portugal'	94.90%		30: 'Korea	99.41%
8: 'Switzerland'	95.05%		31: 'Spain'	99.41%
9: 'Australia'	96.09%		32: 'Sweden'	99.52%
0: 'Costa Rica'	96.34%		33: 'Iceland'	99.58%
11: 'New Zealand'	96.49%		34: 'Serbia'	99.63%
12: 'Brazil'	96.65%		35: 'Czech Republic'	99.66%
13: 'United Arab Emirates'	96.99%		36: 'Hungary'	99.73%
14: 'Greece'	97.04%		37: 'France'	99.76%
15: 'Colombia'	97.27%		38: 'Slovakia'	99.77%
16: 'United Kingdom'	97.90%		39: 'Poland'	99.83%
17: 'Romania'	98.05%		40: 'Slovenia'	100.00%
18: 'Denmark'	98.20%		41: 'Chile'	100.00%
19: 'Austria'	98.38%		42: 'Belgium'	100.00%
20: 'Norway'	98.43%		43: 'Finland'	100.00%
21: 'Japan'	98.45%		44: 'Macedonia'	100.00%
22: 'Germany'	98.46%			

Delay and the question of upload

➢ **Average upload from user – 180Kbps**

➢ **Consequence – no ability to reach high P2P ratio without having many non viewers Average upload from user – 180Kbps**

P2P Info

Channel	Uid	Uri	State	Total_MB	Efficiency	Bitrate_kbps	Clock_Delta	Alloc	Time	ID
Total Donors			1	196.91	100.00%(1.8/1.8)	16.17		1000		
Total Acceptors			6	405.30	0.00%(0.0/0.0)	85.37		18		
46880	1625405	rcv://207.138.101.8:22560	Donor	196.91	100.00%(1.8/1.8)	16.17	0.09	1000	12416	000000000018CD3D
46880	1639469	rcv://157.157.108.133:50364	Acceptor	58.49	0.00	14.85	0.00	3	3	000000000019042D
46880	1728090	rcv://79.97.92.32:55073	Acceptor	9.56	0.00	13.91	0.00	3	1	00000000001A5E5A
46880	1751498	rcv://85.220.86.248:54344	Acceptor	198.44	0.00	16.71	0.00	3	12	00000000001AB9CA
46880	1804995	rcv://86.45.214.210:54088	Acceptor	66.85	0.00	6.49	0.00	3	6	00000000001B8AC3
46880	1850532	rcv://84.71.242.45:22568	Acceptor	61.79	0.00	18.57	0.00	3	3	00000000001C3CA4
46880	1928847	rcv://78.60.194.192:60216	Acceptor	10.17	0.00	14.84	0.00	3	1	00000000001D6E8F

➢**Two ways:**
   ➢**Taking from the few**
   ➢**Using all**

➢**Towards a push/pull protocol to save upload**

➢**PET and Network Coding**

Deploying a P2P system costs

➢ **From multiple POPs to only a few**

    ➢P2P decreases the need for multiple machines within ISPs in Geo-location

    ➢P2P helps in scalability within enterprises, universities, etc

➢ **Costs of streamers – a $3000 machine can support up to 5000 concurrent viewers.**

➢ **Costs of additional POP: location, electricity, men-power**

➢Bandwidth Cost – down to $8 per Mbps in EU and Us, but up to $100 per Mbps in South America, Australia, several countries in south-east Asia

➢ **Analysis shoes that overall the cost with 85% P2P is going to be around $0.6-$0.85 per concurrent viewer per month per 1Mbps quality video.**

Rules

- ➢ **Content owners rules:**
  - ➢Preventing 'their' viewers from contributing to different types of content

- ➢ **Operators/ISP rules:**
  - ➢Our viewers contribute only to our channels
  - ➢Our viewers contribute only at certain hours
  - ➢Caching
  - ➢Reverse Caching

- ➢ **Legal rules**
  - ➢Taxes between countries for PPV content?

- ➢ **Technically implied rules:**
  - ➢Closed territories (china)