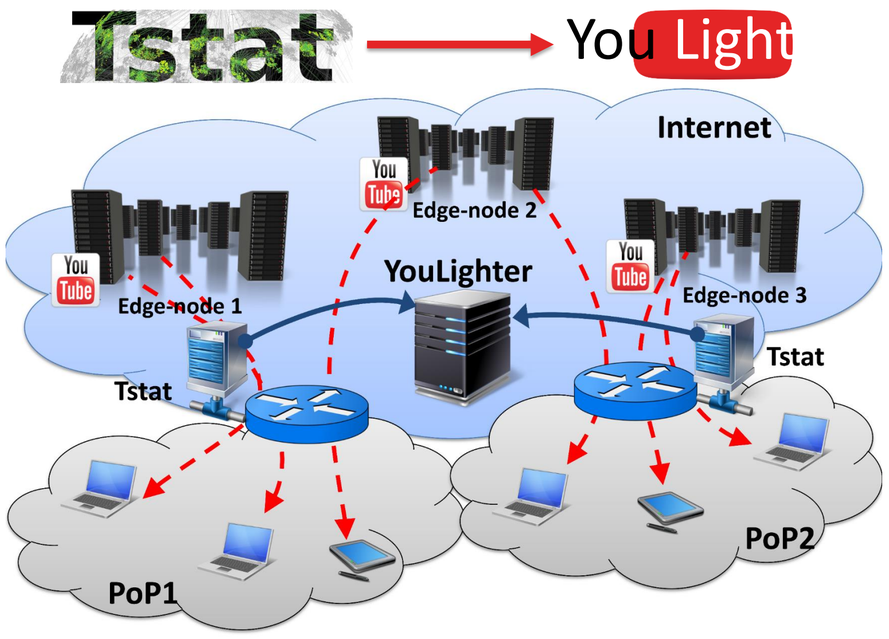
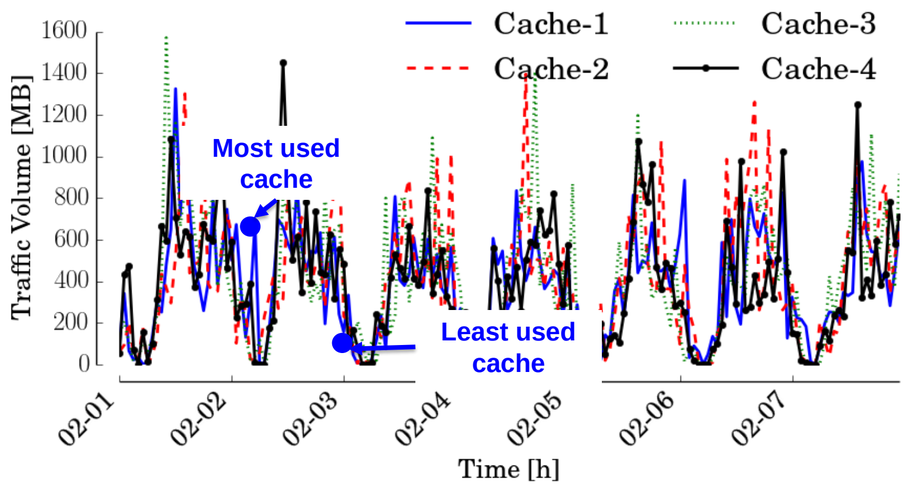
# YouLighter

**Paramount task of YouLighter:**
- Study evolution of YouTube infrastructure
- Highlight change in YouTube infrastructure

**Motivation:**
- It generates 20+% of world wide traffic
- YouTube has a massive distributed infrastructure that is almost unknown
- It uses several thousands of caches (single server) grouped into Hundreds of edge-nodes
- This infrastructure suddenly evolve




**Monitoring the single cache is not effective**
- Load distribution changes very frequently
- The rank of most used caches **changes deeply everyday**!

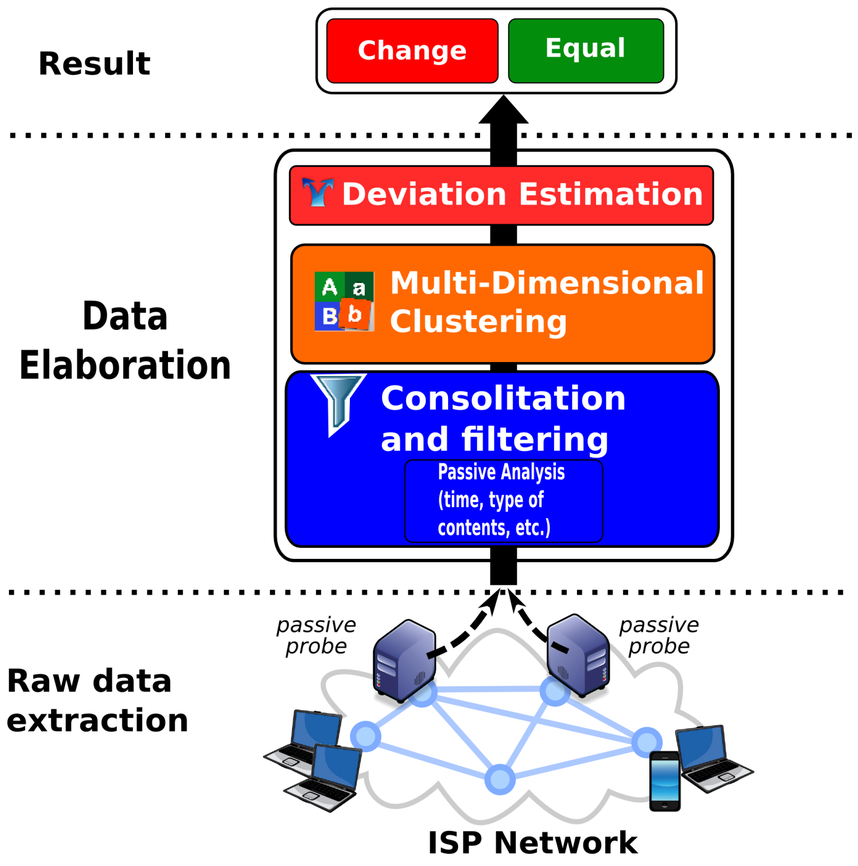


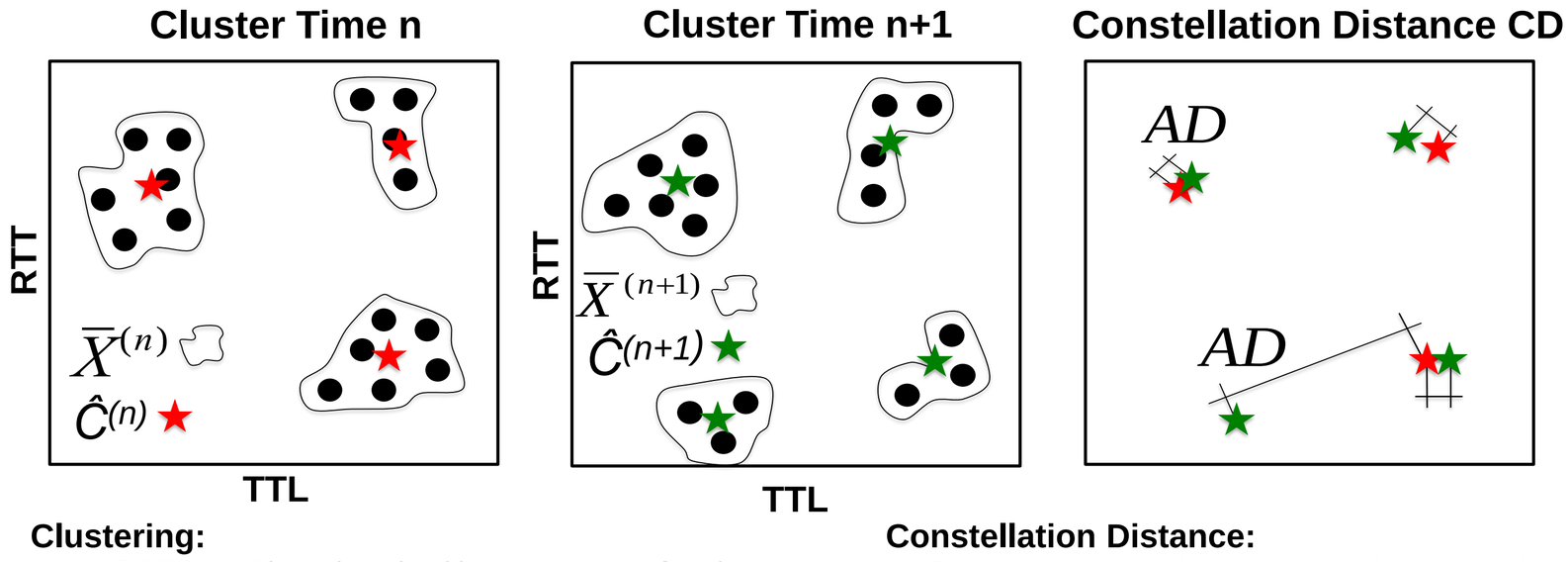

Idea: monitor **edge-nodes**, not **caches**

## Dataset

| Probe | Period | Volume | # Unique Videos | Caches |
|---|---|---|---|---|
| Probe 1 Italy | 01/04/2013 - 28/02/2014 | 138.7 TB | 2,892,452 | 8,664 |
| Probe 1 Italy | 01/04/2013 - 28/02/2014 | 152.9 TB | 2,848,625 | 8,899 |
| Probe 2 Italy | 01/04/2013 - 28/02/2014 | 134.8 TB | 2,711,179 | 9,028 |
| Probe 3 Poland | 01/03/2014 - 17/07/2014 | 48.3 TB | 305,802 | 3,755 |

## Methodology



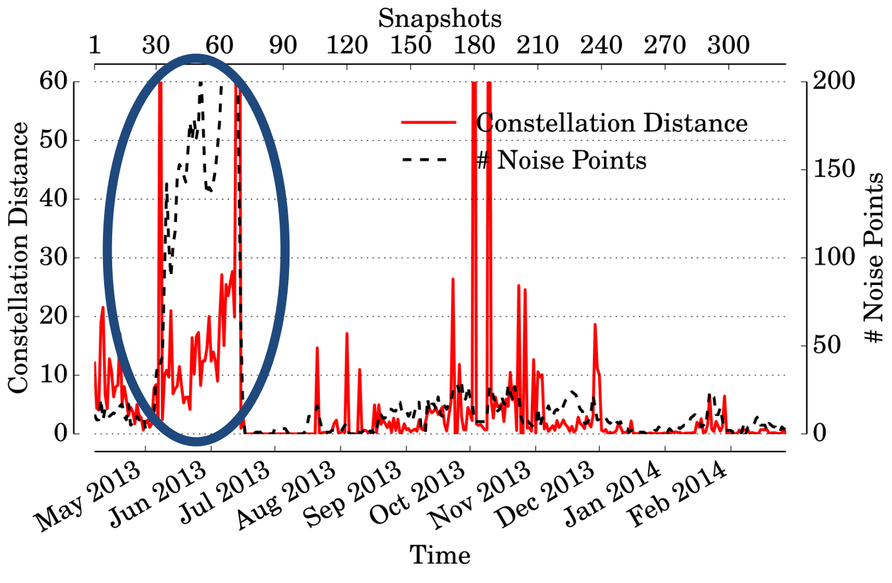




**Clustering:**
- DBSCAN: Clustering Algorithm to group **caches** into **adge-nodes**
- $\overline{X}^{(n)}$: Cluster result at time *n*
- $\hat{C}^{(n)}$: **Centroids** of clusters at time *n*
- *AD: Astral Distance*

**Constellation Distance:**
1. Summarize each cluster in a single point called **star** $\hat{C}^{(n)}$
2. ***Astra Distance***
   - For each star in $\hat{C}^{(n)}$ compute all distances to stars in $\hat{C}^{(n+1)}$ *and the* ***min***
   - *Repeat in the opposite direction*
3. ***Constellation Distance***
   - Sum all Astral Distances

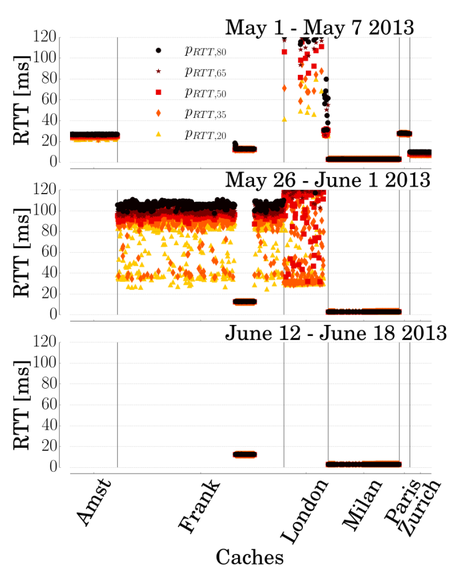
## Results

### Constellation Distance



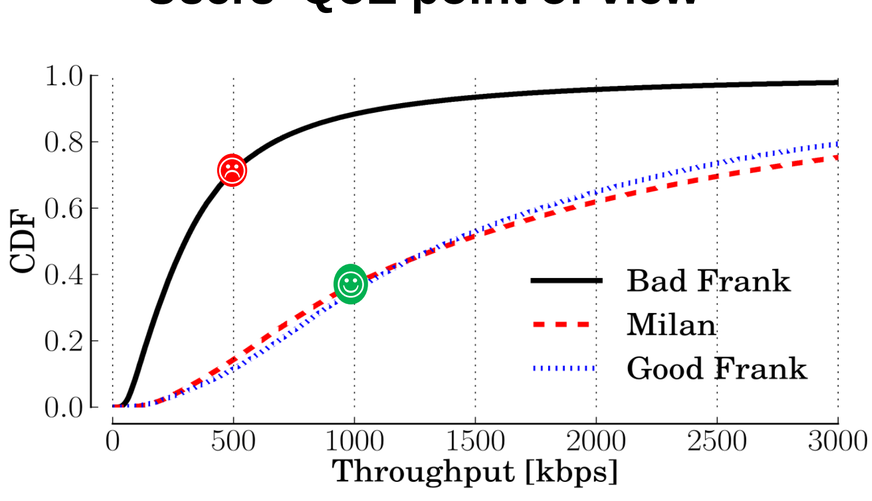

- CD Highlights either small or big
- Important changes during May – July 2013
- Changed confirmed speaking with the ISP of the probe

### Network issue




- RTT before the change shows a stable path
- RTT of Frankfort during the change shows path problems for many caches
- After the change the RTT become again stable

### Users' QoE point of view




- Frankfort is divided in two group based on the RTT range during the change
- Caches belonging to the group with huge range of RTT shows a Throughput distribution worst then Milan caches or caches belonging to the group with correct values of RTT

**Conclusion:** YouLighter shows to be effective at detecting changes in YouTube's CDN infrastructure relying on DBSCAN clustering algorithm and the novel notion of Constellation distance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