Point to Multipoint Streaming Media Delivery Problem Statement

Draft-litao-p2mpsmd-sam-problem-statement-01.txt

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Recall

- Challenges Facing P2MP Streaming Media Delivery
  - High QoE (end-users)
  - Optimized resource utilization (ISPs)
  - Efficient and low-cost deployment, maintenance and management (ISPs/ICPs)
- Major Problems
  - Network state information (NSI) acquisition
  - Policy-based control (Separation between mechanism and policy)

Changes from last version

- Several editorial improvements
- More discussion on the existing technologies
- *Ongoing work and preliminary experimental results (in this presentation)*

Existing Technologies for P2MP Streaming Media Delivery

- IP multicast (SSM)
- RTP/RTCP extensions + SSM
- Application-level overlay (P2P, CDN)

IP Multicast (SSM)

- Network resource (Bandwidth) efficiency
- Complete Standard protocol architecture

Problems:

- *Scalability for maintaining state information*
- *Commercial implementation support (Accounting, group management, Security)*

RTP/RTCP extensions + SSM

- Error resilience
- Monitor and fault isolation
- More delicate control

Problems:

- *Real-time*
- *Accuracy*

P2P

- Robustness and resilience
- Scalability
- Easy Deployment

Problems:

- *Profit of ISP*
- *Management and resource optimization*

CDN

- Reliability
- Manageability
- Safety

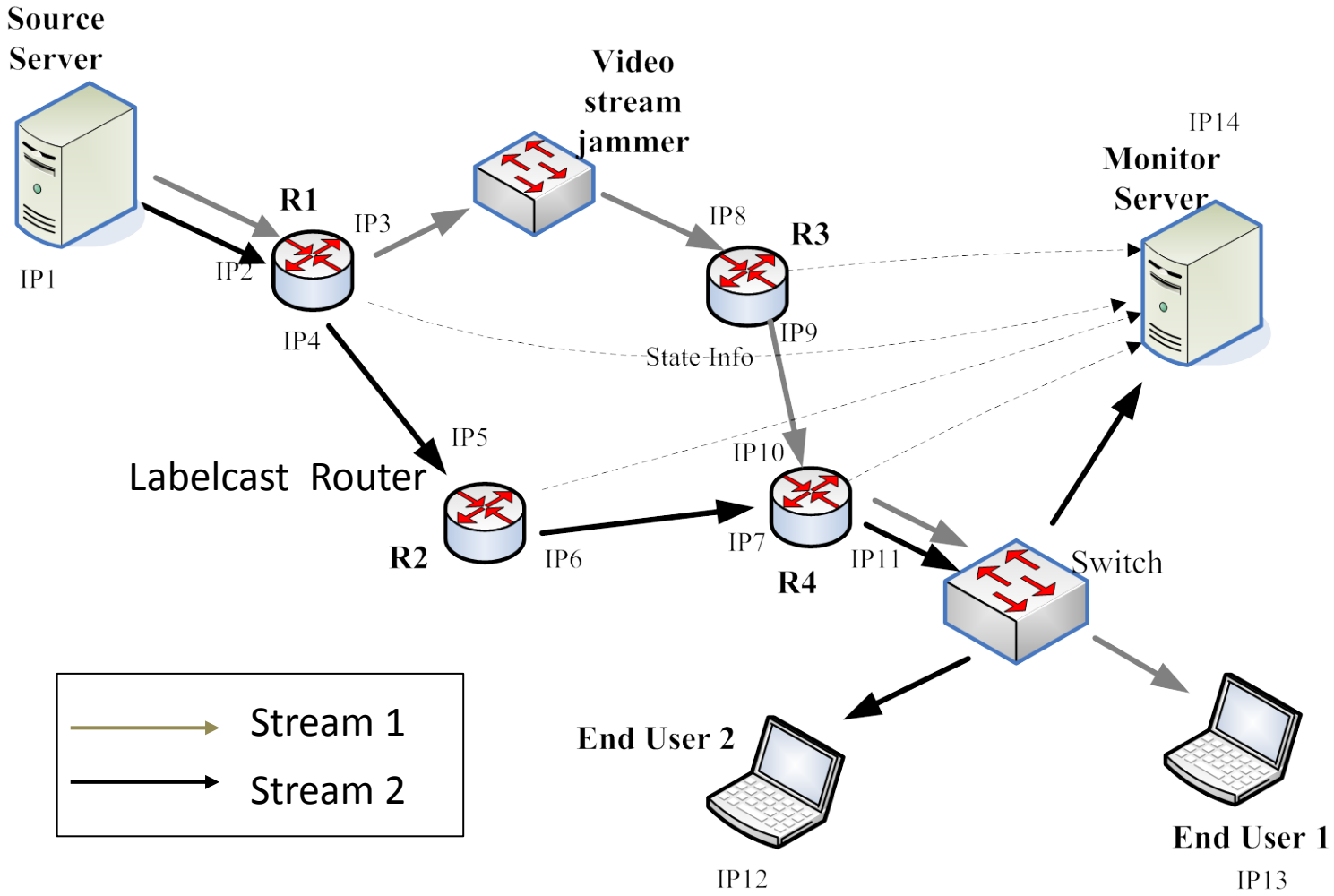
Problems:

- *Cost*
- *Scalability*

Experiments

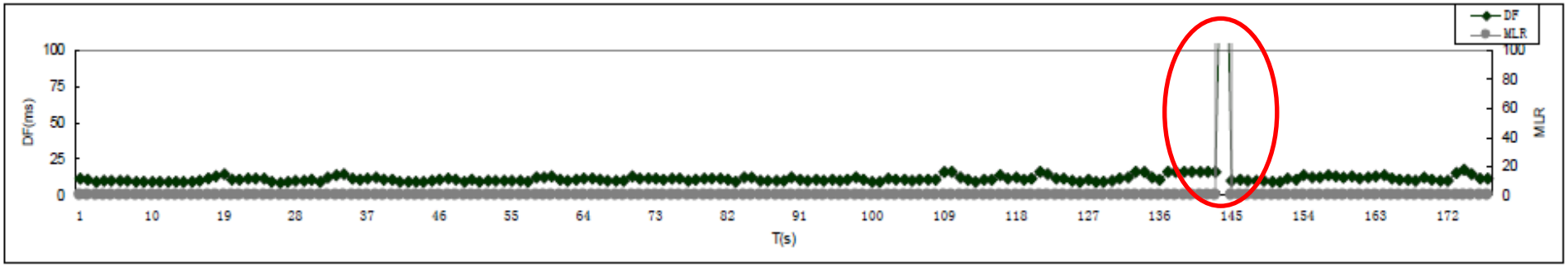
- **Exp-1**: Network state information (NSI) acquisition
  - Real-time monitoring
  - Accuracy locating
- **Exp-2**: Policy-based Control
  - Flexibility
  - Adaptive

Experimental Setup (**Exp-1**)

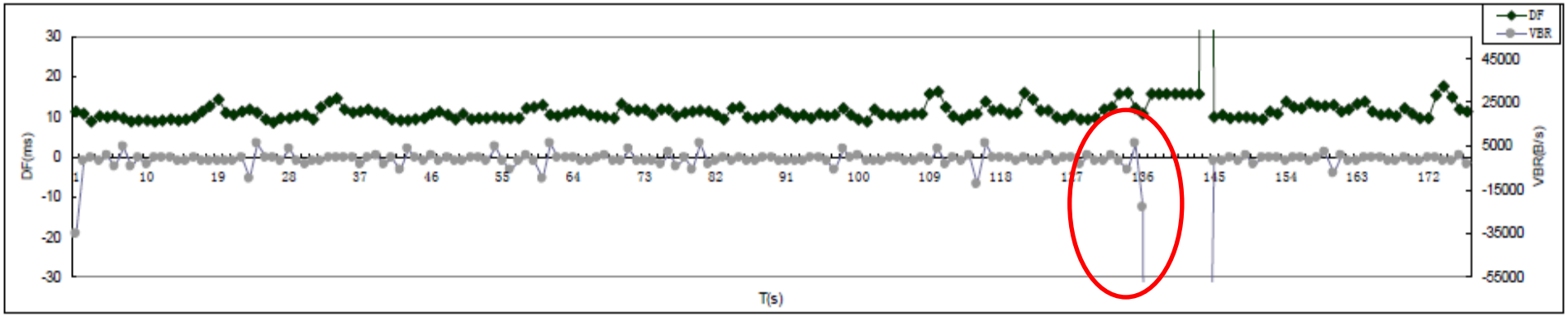


Experimental Results (**Exp-1**)

DF Value: Delay factor (Normally 5~20)



(a) R3: DF and MLR



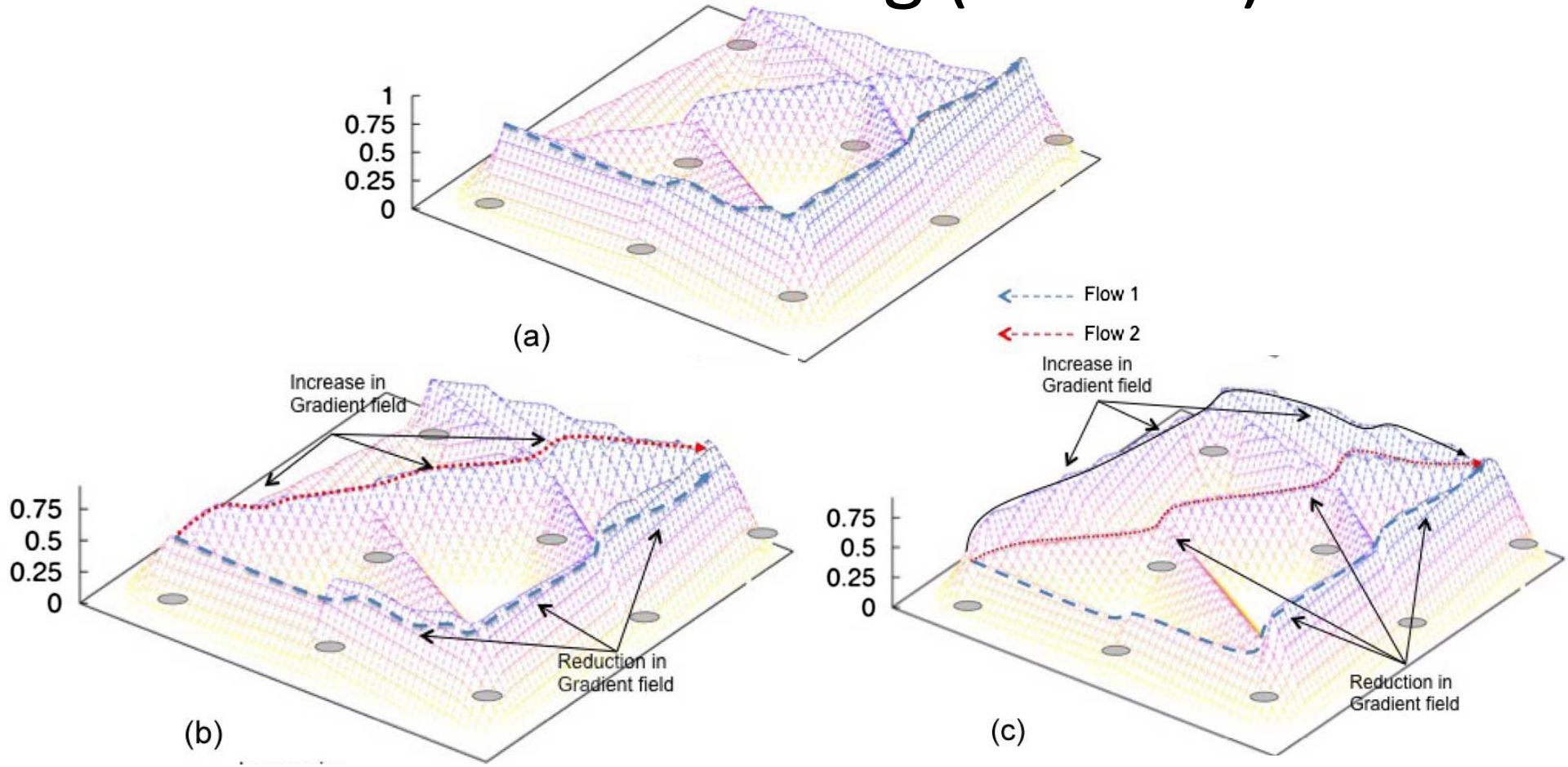
(b) R3: DF and **VBR** (Virtual Buffer Rate)

- Real-time and accurate information of network impairments
- Labelcast provides data-plane NSI
- Independent of control plane or upper layer protocol

EXP-2: Parameterized Gradient Based Multicast Routing (PGBMR)

- Objective
  - An **adaptive** multicast routing mechanism supporting **parameterized policy-based** p2mp streaming media delivery
- Motivated by
  - PGBR ["An Evaluation of Parameterized Gradient Based Routing With QoE Monitoring for Multiple IPTV Providers", ITOB 2010]

EXP-2: Parameterized Gradient Based Multicast Routing (PGBMR)



PGBR ["An Evaluation of Parameterized Gradient Based Routing With QoE Monitoring for Multiple IPTV Providers", ITOB 2010]

EXP-2: PGBMR Experimental Setup

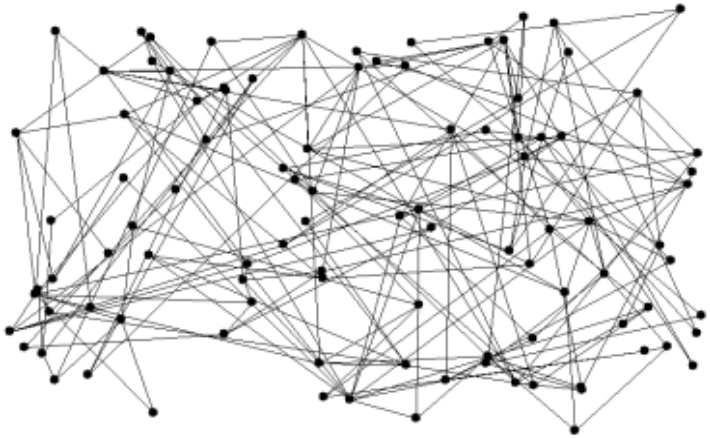
$$G_{u\to v,s,d_i}(t) = \alpha\varphi_v(t) + \beta l_{u\to v}(t) + \gamma h_{v,s,d_i}$$

$\varphi_v(t)$: Whether node v is in the multicast tree or not

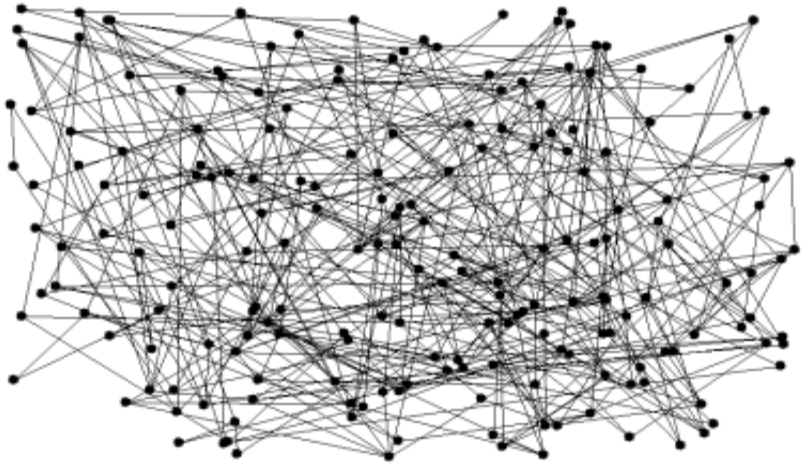
$l_{u\to v}(t)$: The residual capacity of the link $e_{u,v}$ at time t

h_{v,s,d_i} : The normalized total hop counts.

Different parameters allow for the different polices

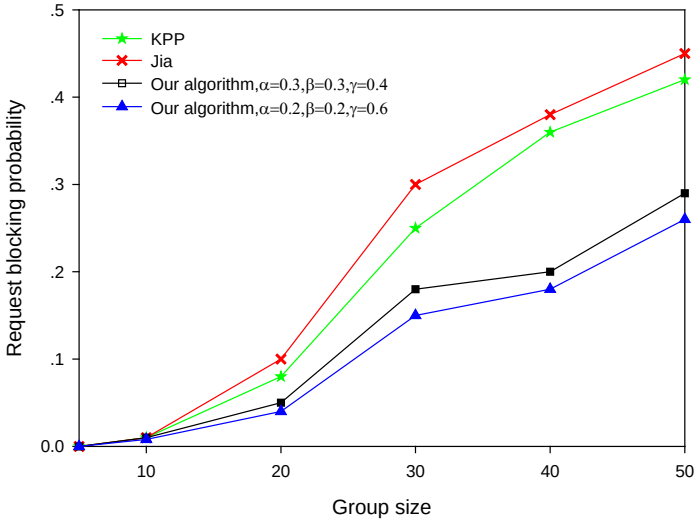


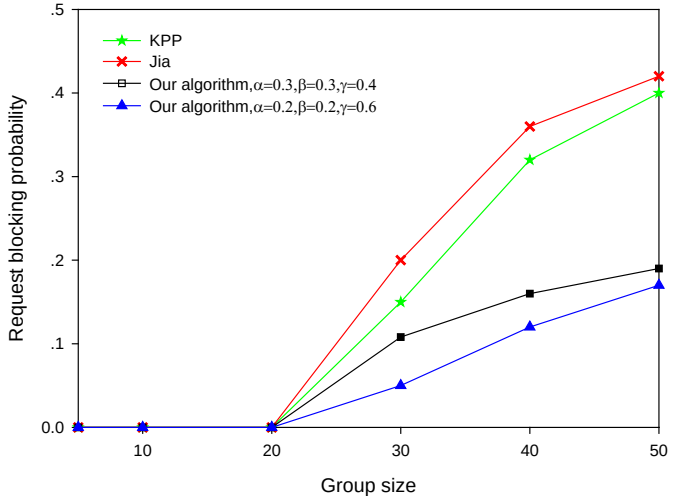
(a) n=100



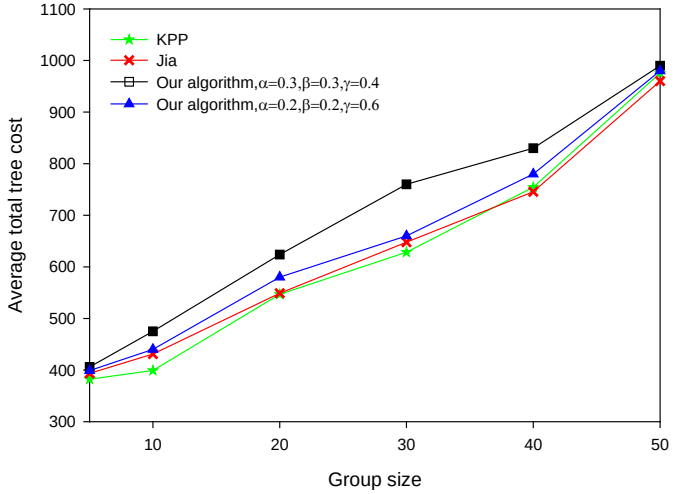
(a) n=200

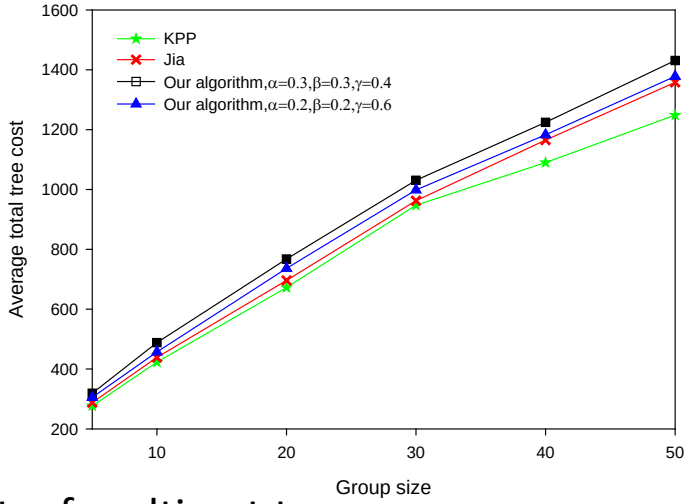
EXP-2: PGBMR Experimental Results





Comparison of Request blocking probability





Comparison of total cost of multicast tree

From "Greedy Gradient Based Multicast Routing Policy for Dynamic Network, ICMT2011"

Remarks

- NSI is essential for **real-time** monitoring and **accurately** locating the impairment of the network.
- Policy-based control for flexibility is feasible to be implemented by separating the **policies** from the **mechanism**.

Comments or questions?