Identifying Traffic Prioritization on the Internet

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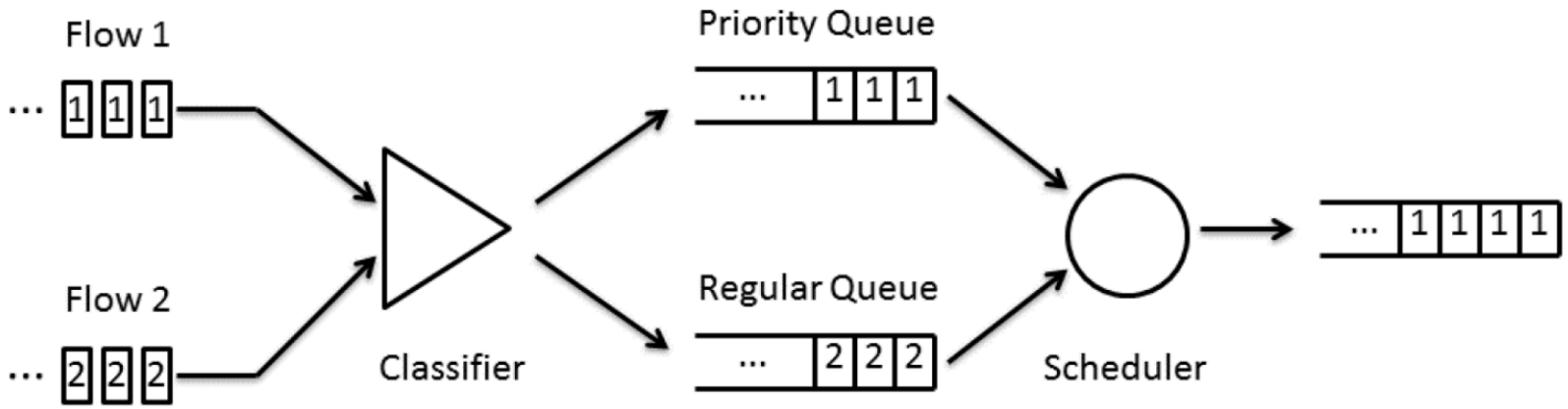
Introduction

- Many ISPs use traffic differentiation to manage scarce resources
- Traffic prioritization is one of various popular approaches
- Strict Priority Queueing (SPQ)

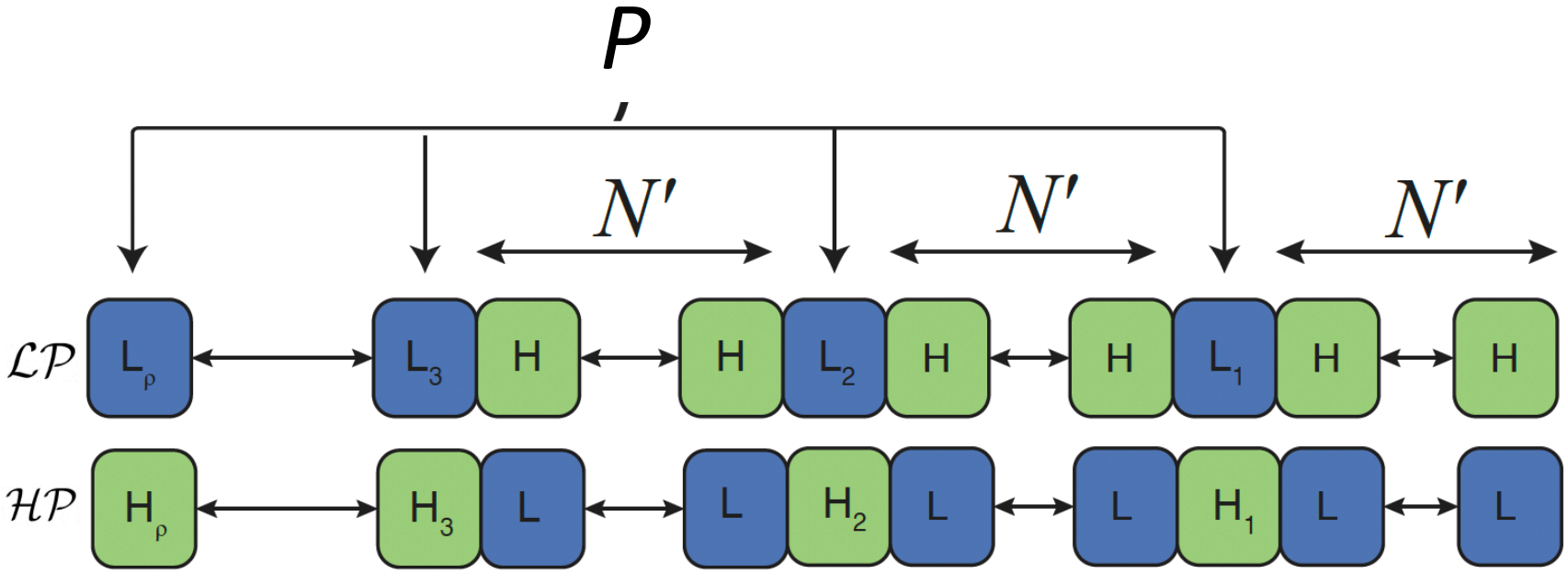


Why Detecting Prioritization?

- Low priority traffic may starve
- SPQ's hostile nature towards
  - Detrimental effects on TCP-based application
  - Delay-sensitive network applications
- To ensure bandwidth and latency requirements for specific metaverse applications (e.g., streaming 360 degree VR experience)
- Others:
  - Net neutrality compliance
  - Transparency in nonregulated environment
  - Eliminating bias in measuring network path characteristics
    - Critical to diagnosis, optimization, troubleshooting and development of distributed services

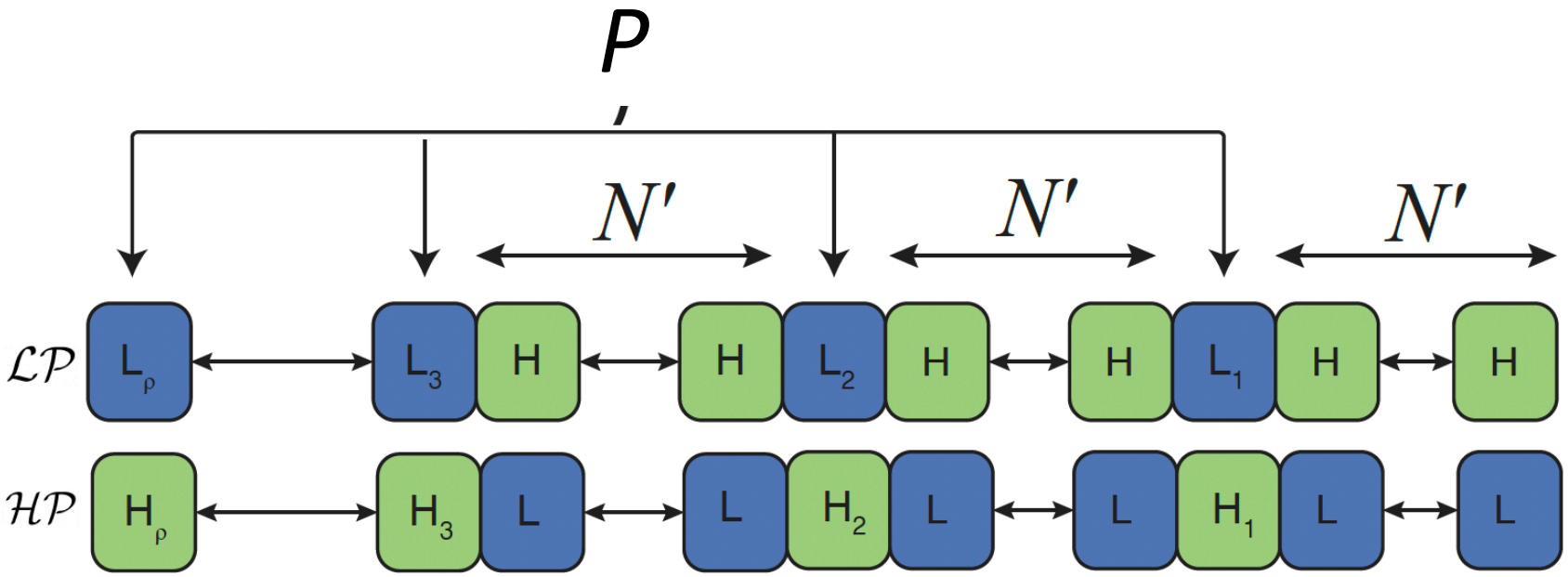
Methodology

- Interleaving high and low priority packets
- Two phases: in each phase, performance of only one priority class is measured.
- We use loss as performance metric.
- The difference in loss is greater than a threshold (20%)

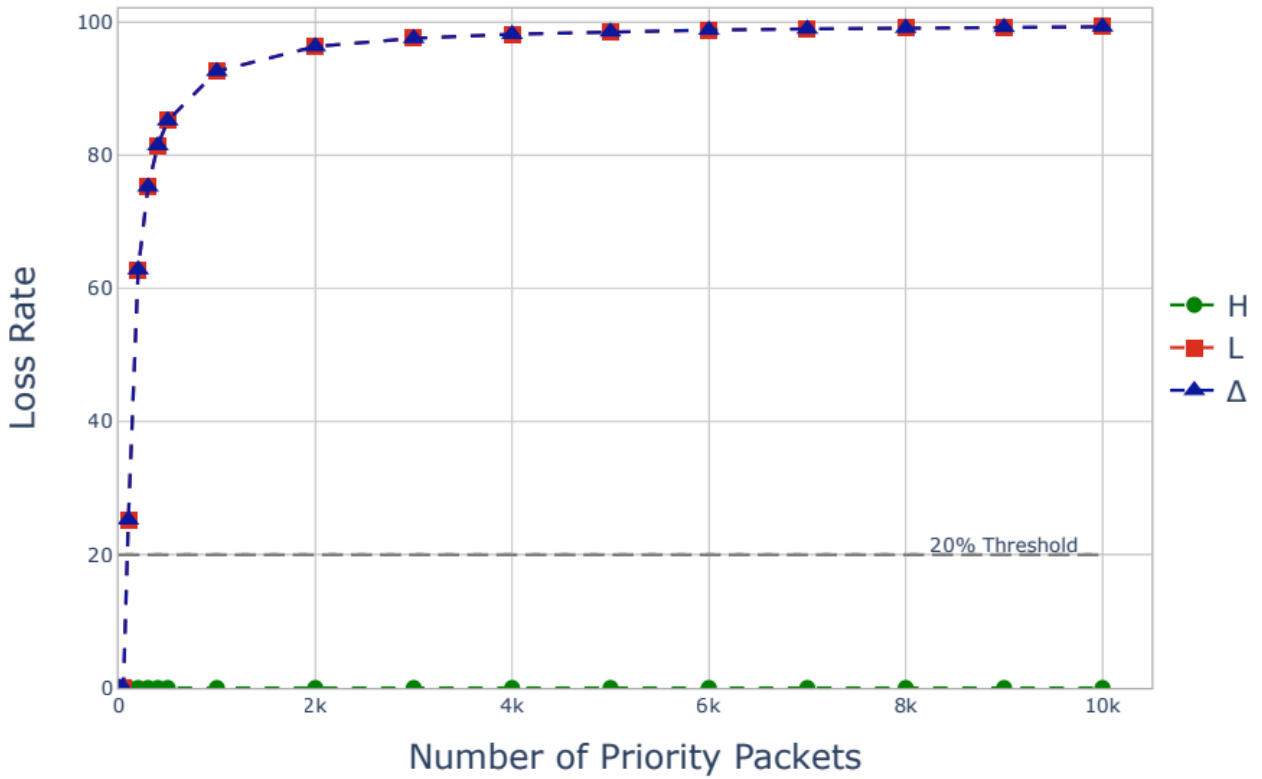


Simulations and Parameters Selection

- Number of measurements
  - 24 times once every hour
- *P, N'*



Simulations and Parameters Selection: *P*



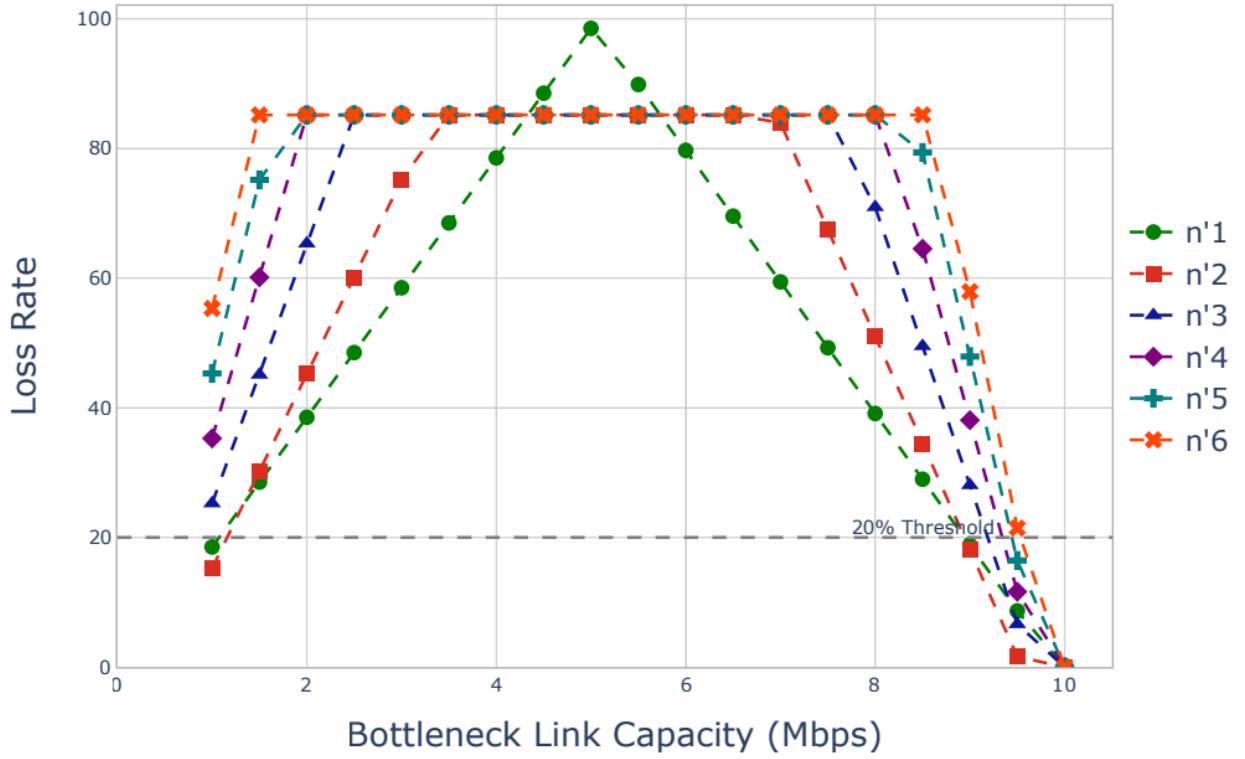
The effects of total number of packets of interests (*P*) on detection accuracy.

Simulations and Parameters Selection: *N'*

- We aim to develop a detection tool that is non-intrusive.
  - So we need to find the smallest value for *N'* that achieves a high degree of detection accuracy.
- Objective 1: In *HP*, we make sure high priority queue never builds up.
- Objective 2: In *LP*, high priority queue is never empty.
- *Z*: The link capacity of the outgoing link from SPQ (typically the bottleneck).
- *r*: The sending rate of the probe packets as perceived by SPQ.

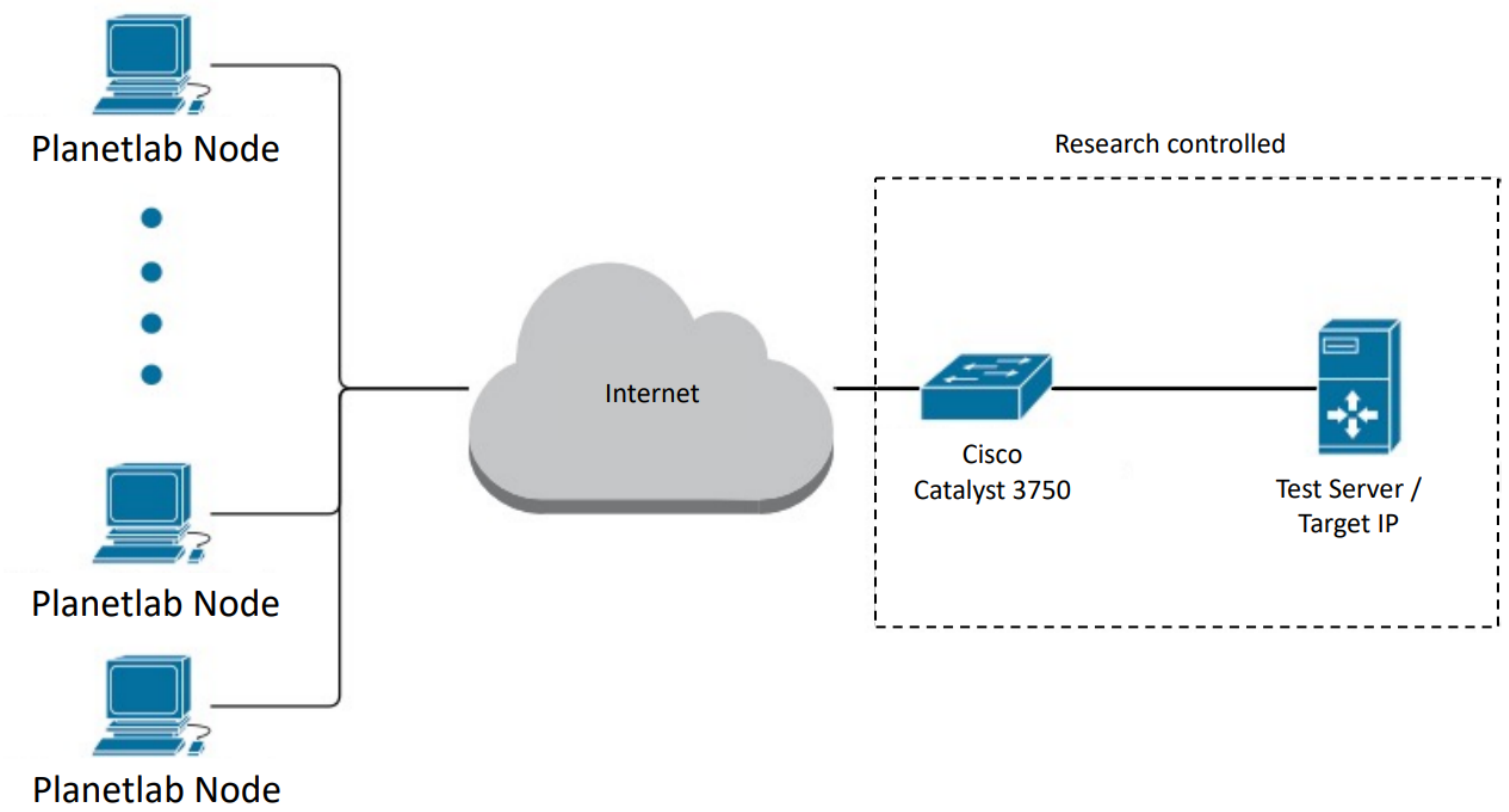
$$N' \geq \left\lceil max(\frac{r-Z}{Z}, \frac{Z}{r-Z}) \right\rceil$$

Simulations and Parameters Selection: *N'*

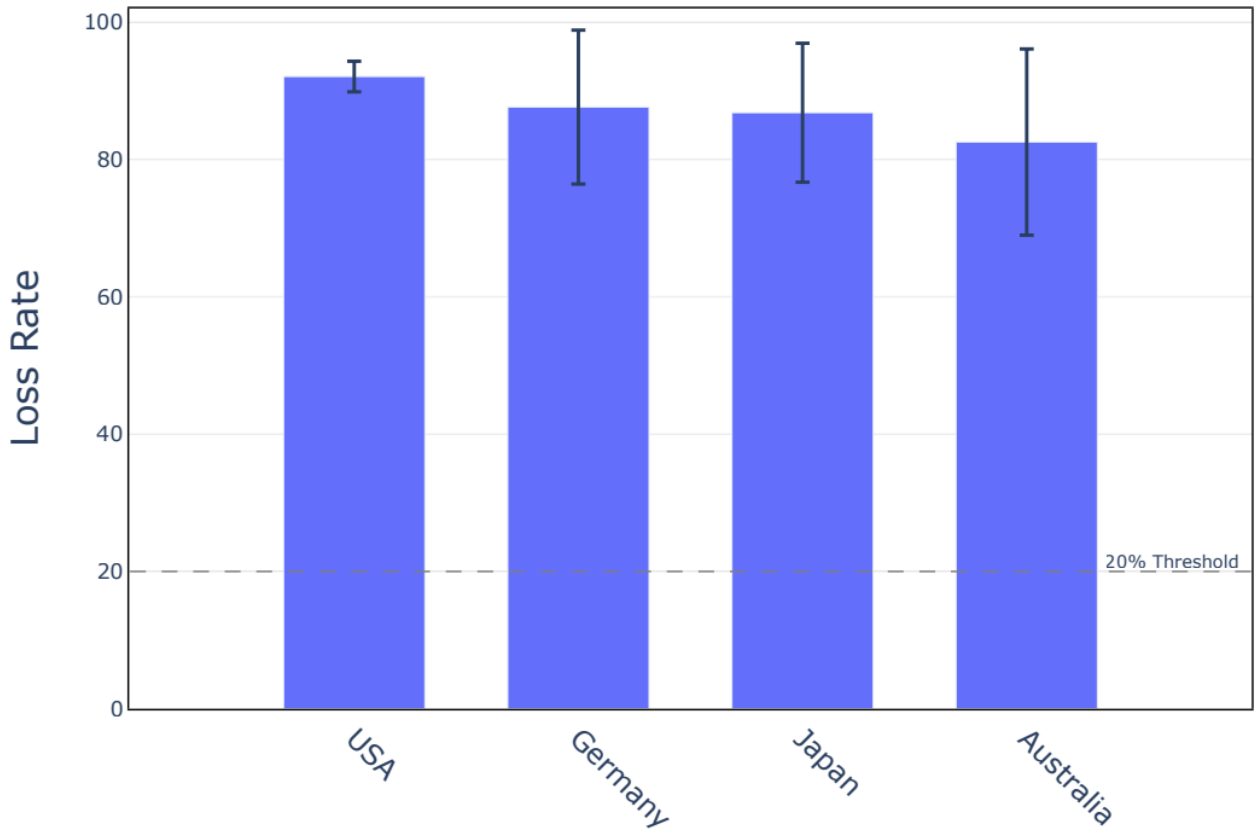


The effects of the separation packet train length (N') and the sending-rate-to-bottleneck ratio (r/Z) on detection accuracy.

Internet Experiments Environment



Internet Experiments



PlanetLab nodes used in our internet evaluation

Sender's Domain Name	IP Address	Location	RTT
planetlab2.cs.ucla.edu	131.179.150.72	USA	14.3 ms
pl1.uni-rostock.de	139.30.241.191	Germany	156 ms
pl1.sos.info.hiroshima-cu.ac.jp	165.242.90.128	Japan	126 ms
planetlab.research.nicta.com.au	130.216.1.22	Australia	152 ms

Summary

- Traffic prioritization is a popular traffic discrimination approach employed by ISPs.
- Most ISPs do not reveal their treatment (or mistreatment) of certain traffic.
- We developed and evaluated a new tool for accurately detecting SPQ.
- Our approach is a packet-train-like active probing tool that infers *perceivable* discrimination.