Speculative Authorizations

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Problem
Lack of mechanisms that can understand subject behaviour of accessing resources in distributed systems and eventually prefetch authorization responses for resources that would probably be requested in future

Requirements
- Model should not interfere with regular operations
- Accurately understand subject behaviour and obtain high hit rate
- Computation of policies expensive, thus unused responses should be minimal in cache
- Model should attain high sensitivity
- Area under ROC curve should be as high as possible
- Incorporate prediction for resources added at runtime
- Model should not generate infeasible requests

Comparison to Related Work
Resources in distributed system differ from web pages
- Not all resources can be accessed by every other subject
- Different subjects have different access level on different resources
- Range of resources to be considered is higher
- Storage size of access responses very small
- Dynamic changes in system need to be considered, e.g. new resources being added
- Optimum feature selection required to find tradeoff between complexity and sensitivity

Approach
- **Existing resources**: Check for relationship between resources and associated permissions using mixture of first order Markov Model
- **New resources**: Allocate weight to resources added at runtime based on position where they get added

Design
- **Existing resources**: When subject requests for permission on any existing resource, check for
  - Past behavior of subject after this request
  - Behavior of other subjects (same group/role) after this request
  - Overall current behavior of subject
  - Resource type (Public/Private)
- **New resources**: When subject adds new resources at runtime
  - Position indicates weight of resource
  - Decrement weight as time progresses
  - Further prediction would rely on ‘existing resources’ mechanism

Experiments, Ongoing Work and Initial Results
- We obtained log traces from online distance education course having 12 instructors, 3 teaching assistants and 80 students
- Instructors and teaching assistants have accesses to more resources than students with greater set of permissions on all resources
- Trace contains 200,000 requests made during entire duration of course
- Instructors and teaching assistants can add course material, discussion topics and students can post replies to these topics
- Overall, the trace is a representation of enterprise system where policy enforcement is crucial
- Initial results for existing resources suggest hit rate of 47% as compared to 38% using regular first order Markov Model
- The decrement of weight for new resources added at runtime follows Poisson distribution