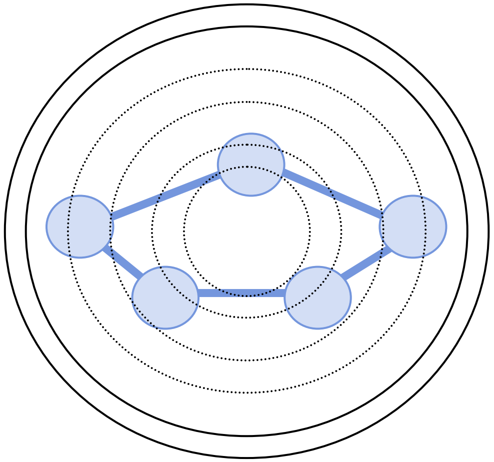
Integrating Policy-based Management and Adaptive Traffic Engineering for QoS Deployment



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Policy 04

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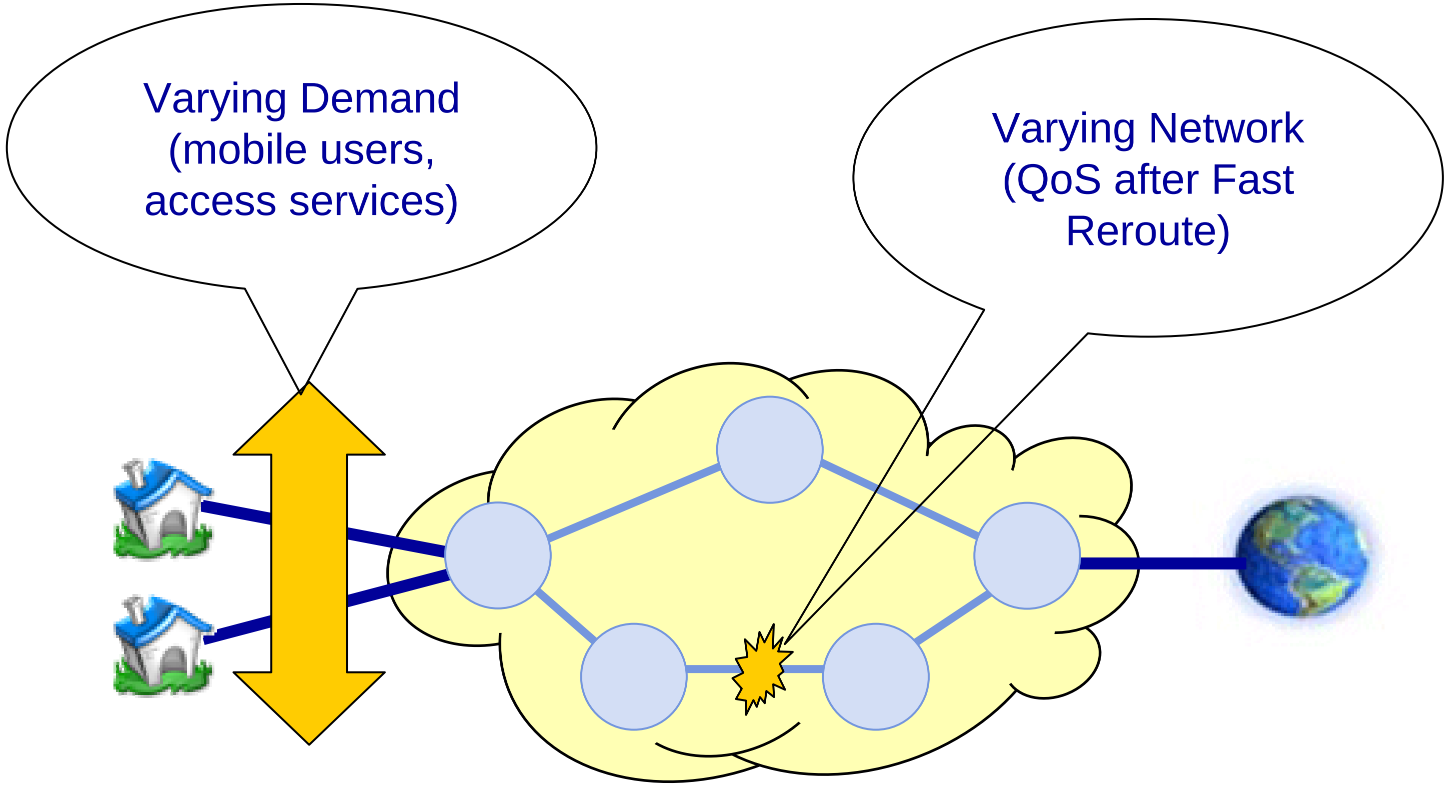
Goal

- Service Differentiation
  - Based on transport characteristics (~DiffServ)
  - Based on availability characteristics
  - Based on survivability characteristics
- Flexible: QoS-deployment with ‘classic’ features such as roaming, …



Approach

- QoS Resource Management:
  - Paths (MPLS) & Per Hop (DiffServ)
  - Calculation (Dimensioning) and Implementation (provisioning)
  - For different service types (session based & connection-less)
- Policy-based configuration methodology
  - PDP-PDP-PEP interaction:
    - central decision unit for longer term dimensioning
    - Local (edge) decision unit for short term load-balancing
    - Network-wide implementation unit for, well, implementing the service (=RSVP-TE, DiffServ config + monitoring)
  - Input = Demand Matrix, Output = DS/MPLS-config
  - optional explicit session activations (e.g. telephone calls)

- **Adaptive**: use monitoring to perform load-balancing

SONAR Architecture

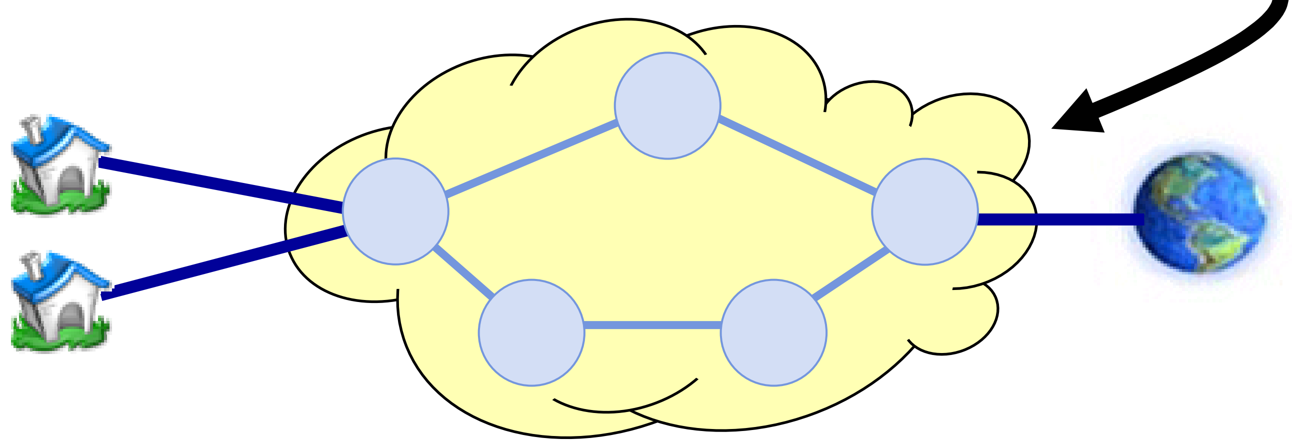
Service Overlay Networking using Adaptive Resource management

- PDP
  - Perform TE-algorithms

- SIP proxy
  - Manage QoS-sessions

- Local (edge) PDP
  - Add mappings, manage trunks

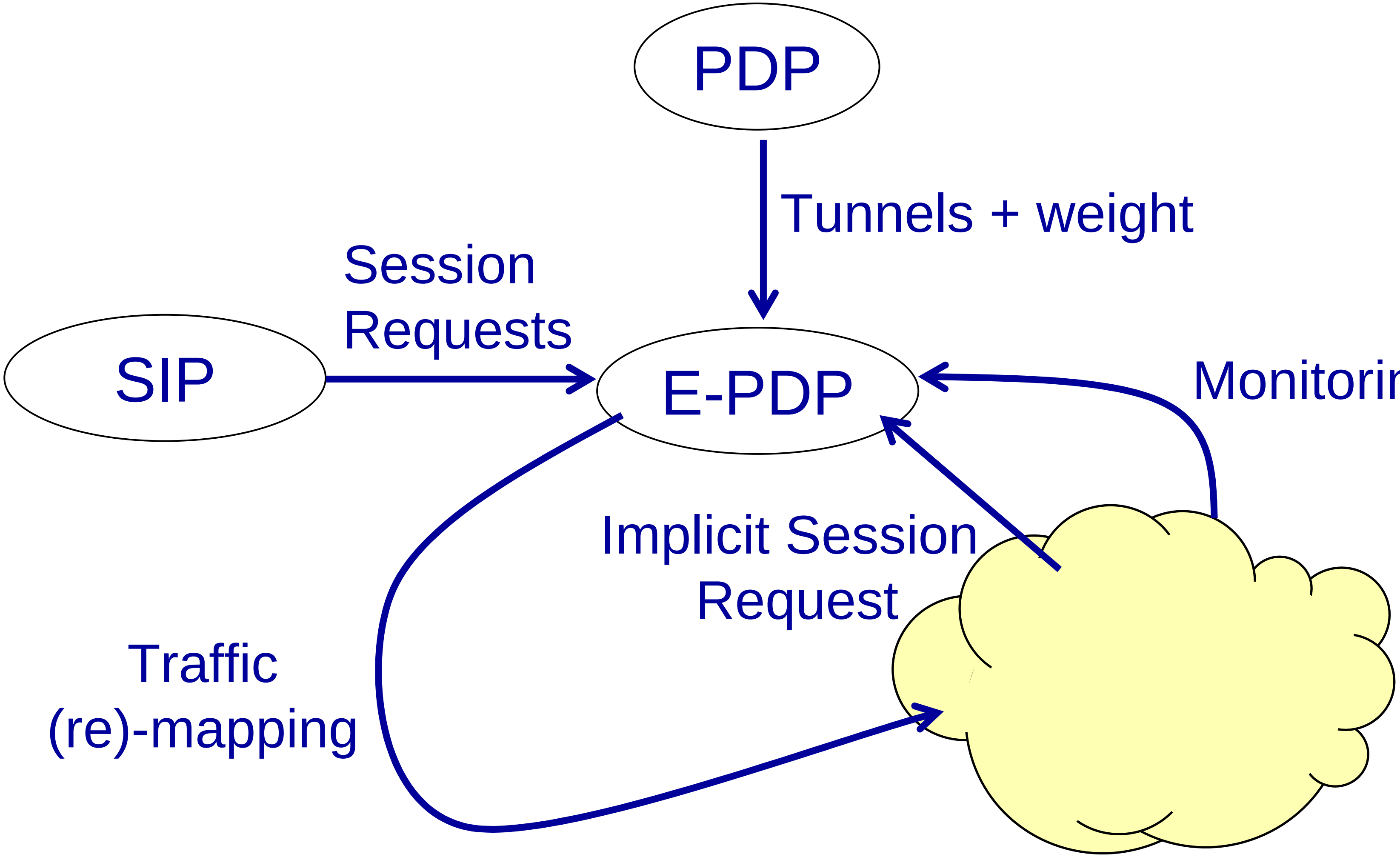
- PEP: configuration
  - Drive RSVP-TE
  - Do Traffic Mapping
  - Configure & Monitor DiffServ



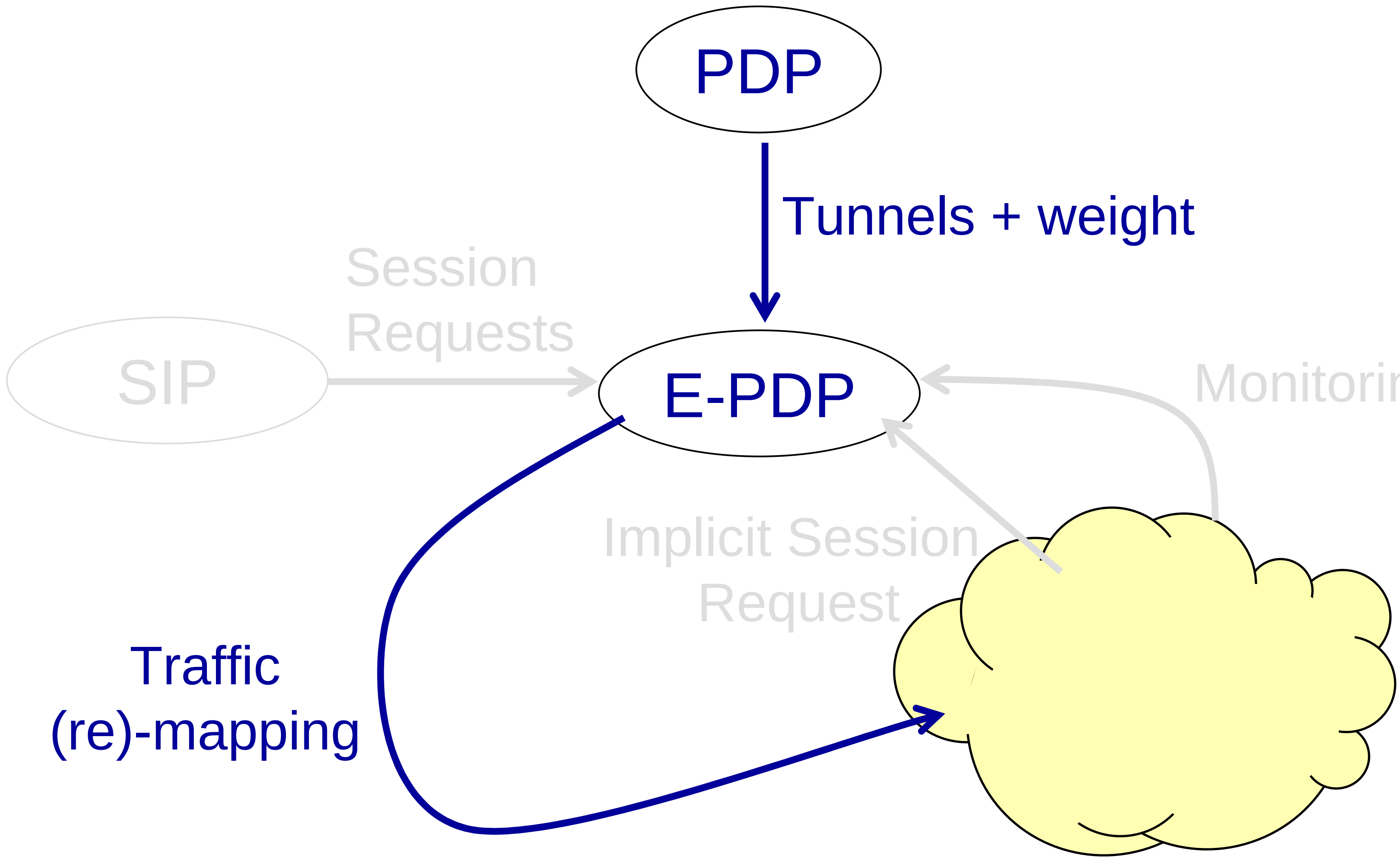
Outline

- Introduction (done)
- SONAR Architecture: E-PDP
- Admission Control
  - Why we don’t need to invent new technologies/protocols
  - Registration/activation processes
- Conclusion

E-PDP architecture

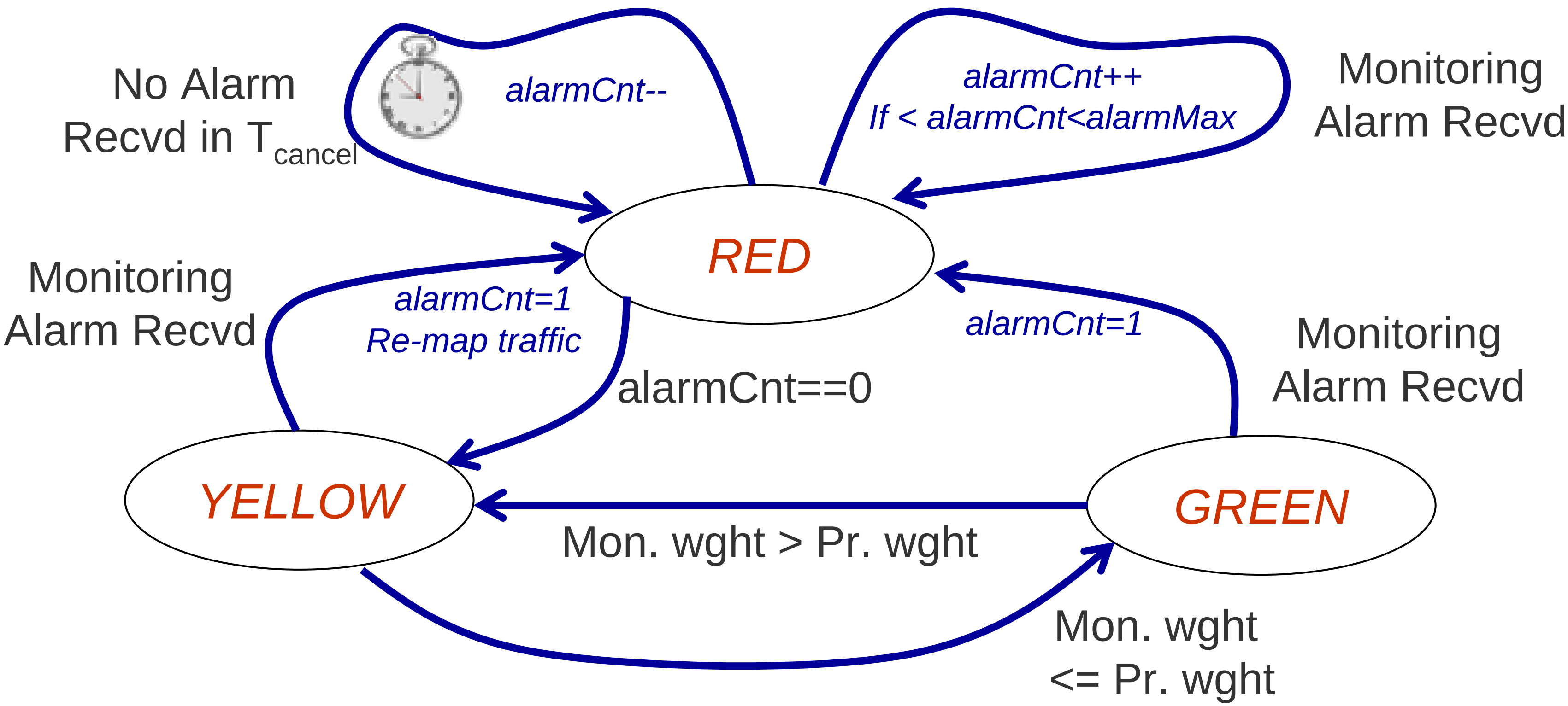


E-PDP architecture



Traffic (Re-)Mapping

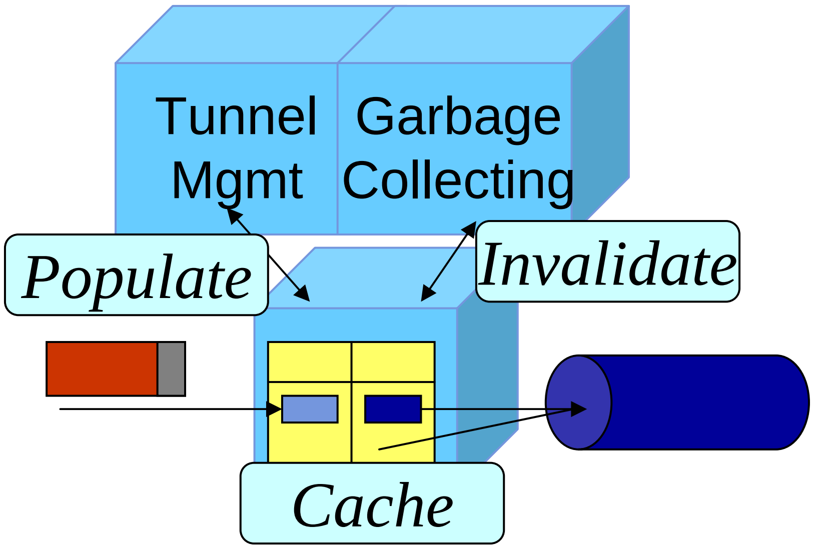
- PDP gives L-PDP a set of tunnels and weights
- Mapping depends on ingress classification mechanism
  - Flow-based classifier: need to translate into flow mappings
  - *Hashing based classifier: can use weight as input (future work)*
- E-LSP can be in 3 states: GREEN / YELLOW / RED



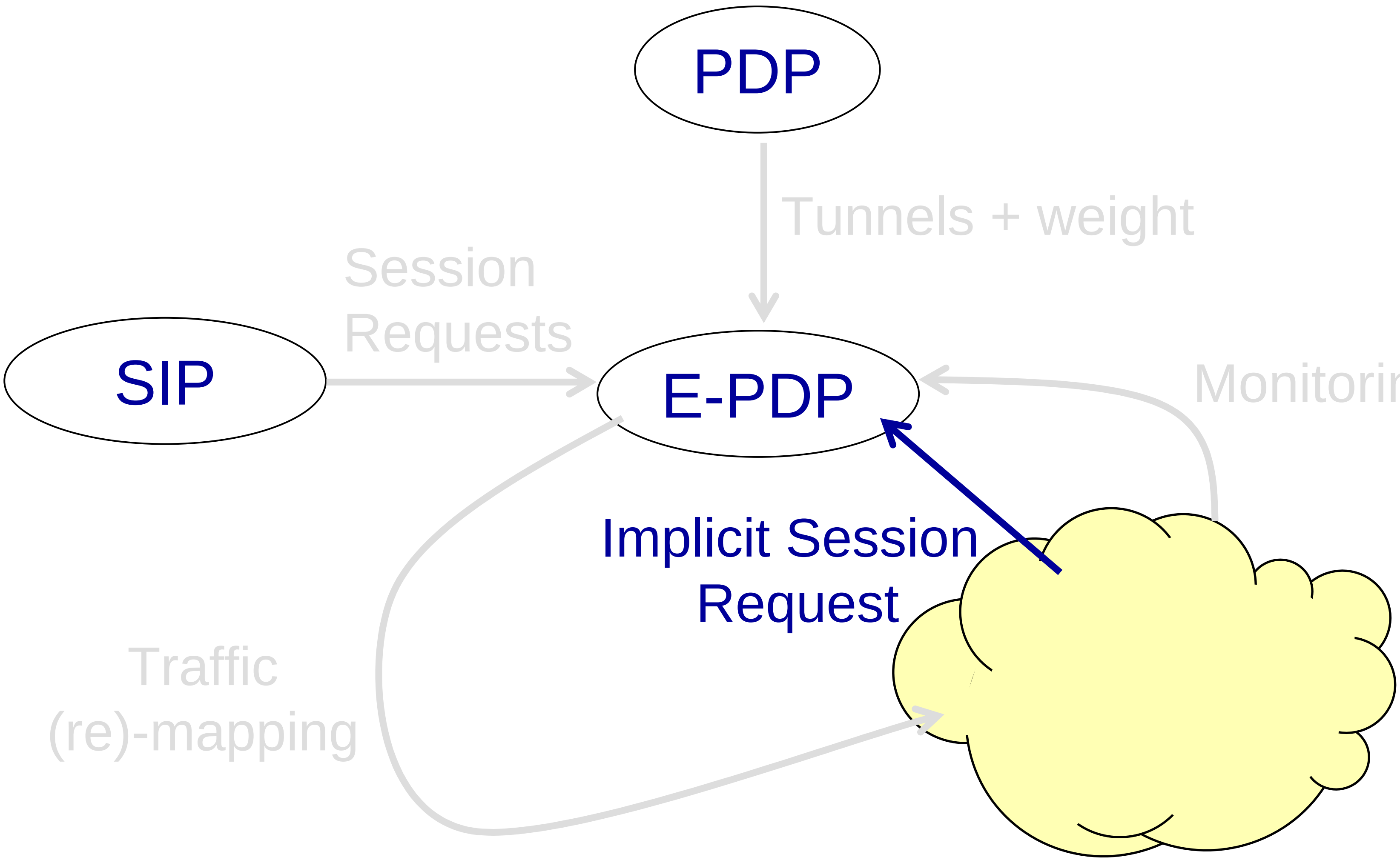
Traffic (Re-)Mapping

- new flow activation algorithm:
  - ∃ E-LSP in ‘*green*’-state: map flow to E-LSP (WRR)
  - else ∃ E-LSP in ‘*yellow*’-state: map flow to E-LSP (WRR)
  - else block flow

- Can also be running flow whose mapping gets ‘garbage-collected’ (cf. infra)



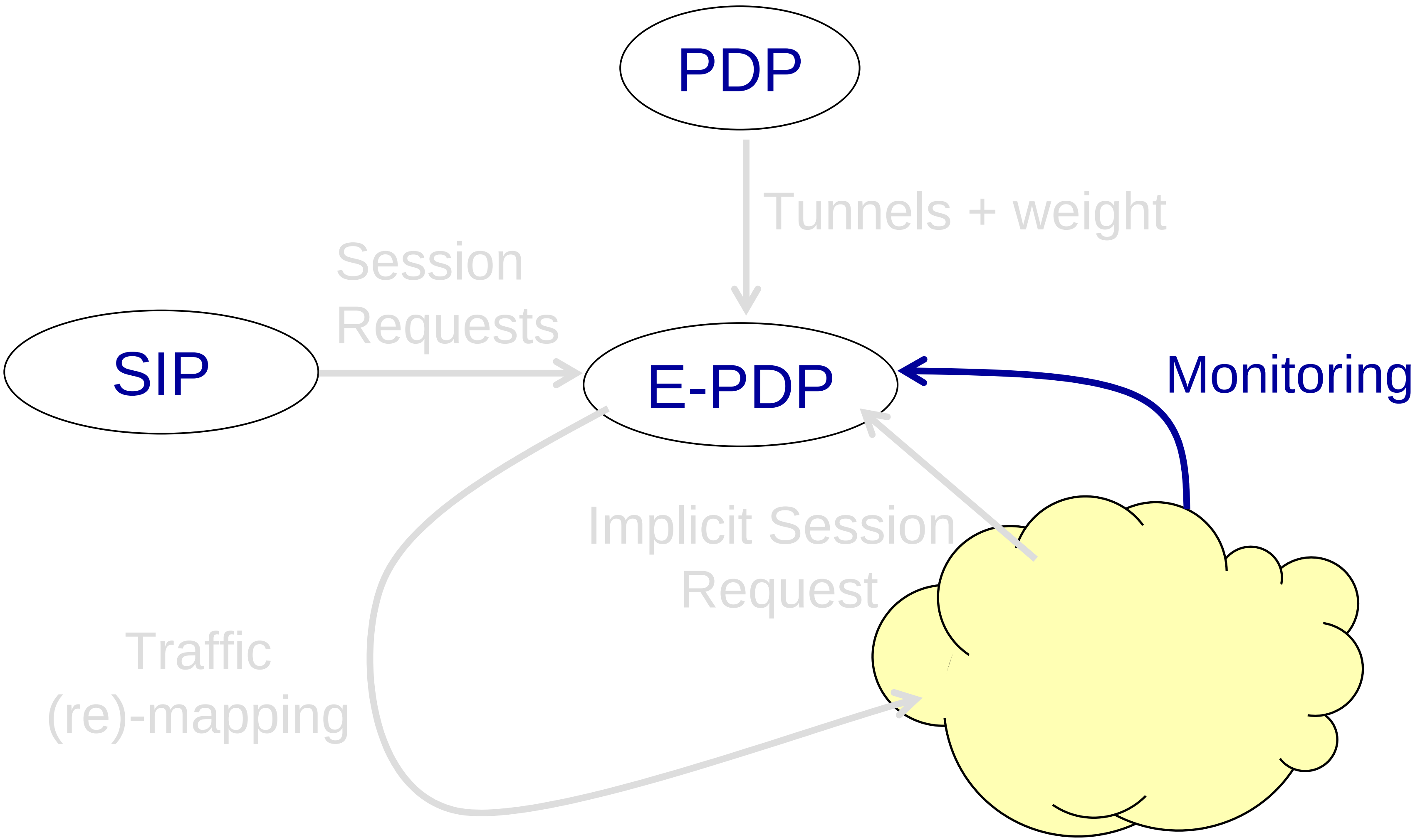
EPDP architecture



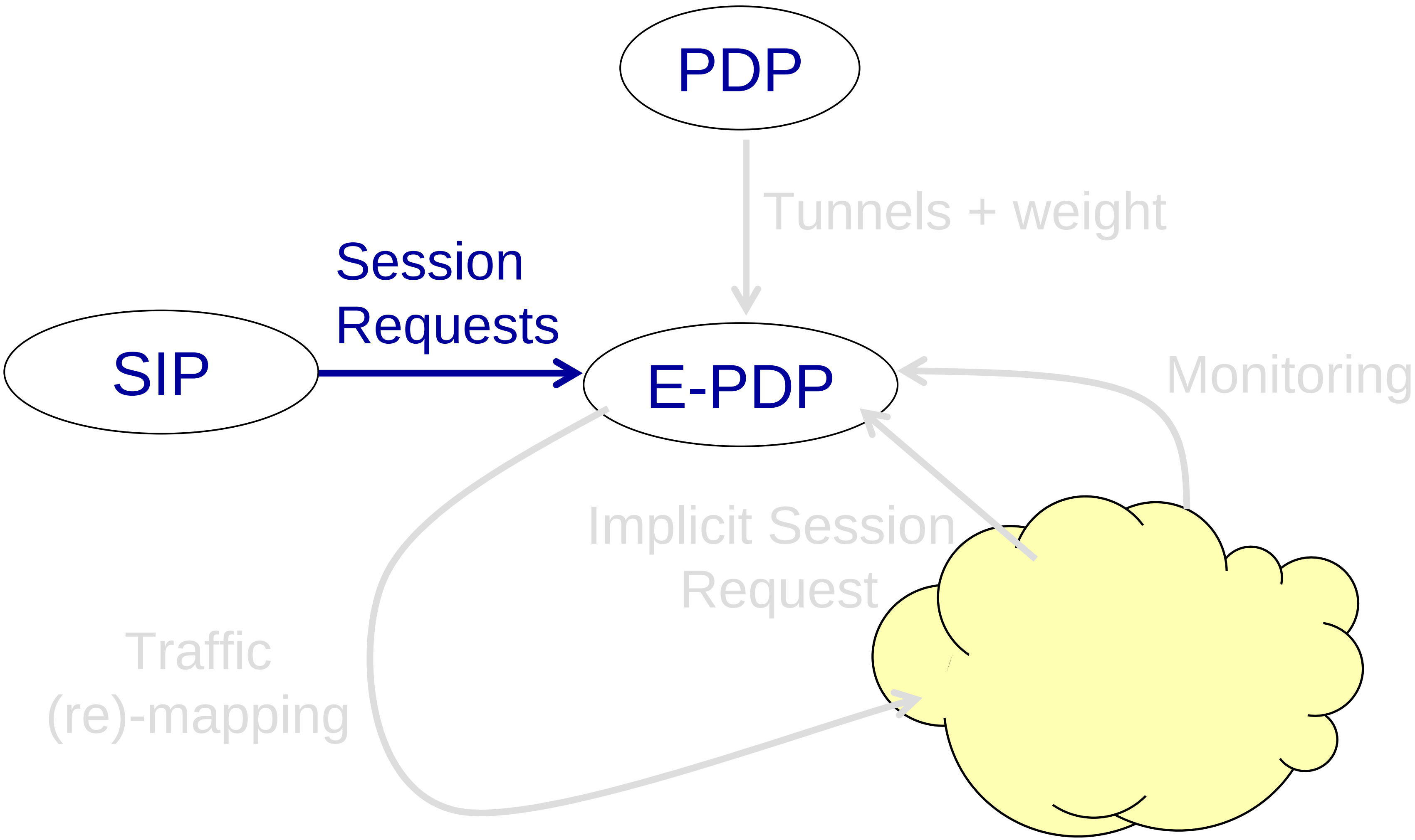
Implicit flow request

- ~ route caching:
  - hashing-based lookup of <src,dst,DSCP,proto,srcprt,dstprt>
    - If found, use attached LSPid
    - If not found, get new LSPid (➔ L-PDP must be embedded in slow-path of ingress)
  - garbage collecting on cache
- T_{gc}: cache garbage collecting time-out defined per service:
  - main importance: delays effect of re-mapping for running services
  - should be > average service duration for short sessions (e.g. WWW-browsing)
  - should be limited for other services (e.g. maximum of 2 re-mappings during a video-conferencing)
  - should be small enough to allow re-mapping to have effect

EPDP architecture



EPDP architecture



Explicit Service Level CAC

- For some services QoS=better no than bad connection
  - e.g. current telephony service
- Take time for explicit service invocation & CaC
  - Trade-off: invocation time vs. quality

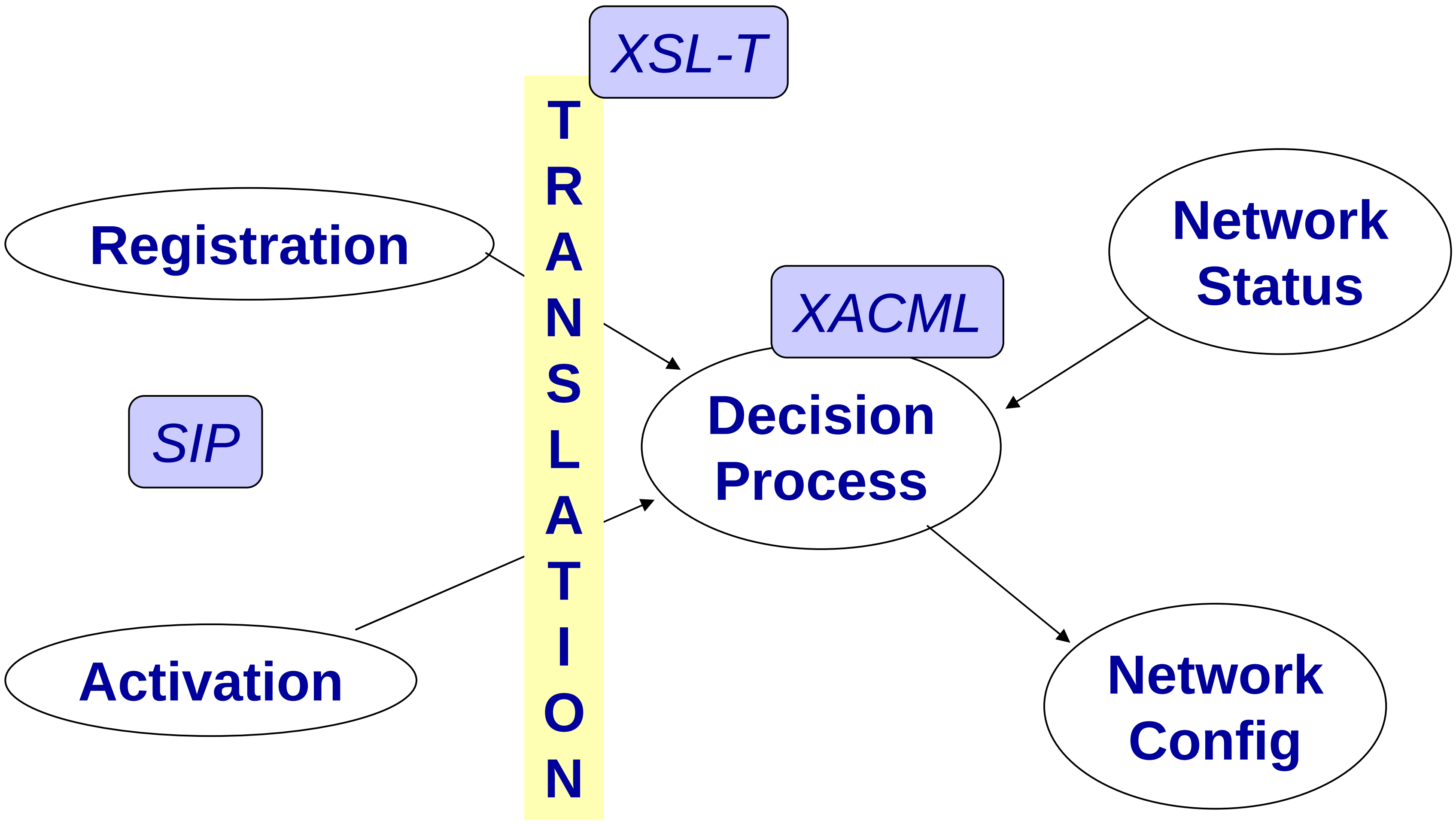
- Solution: take underlying LSP states into account
  - for example:

$$p(accepted) = 1 - \frac{\#lsp_{Yellow}}{\#lsp_{Yellow} + \#lsp_{\mathrm{Red}}}$$

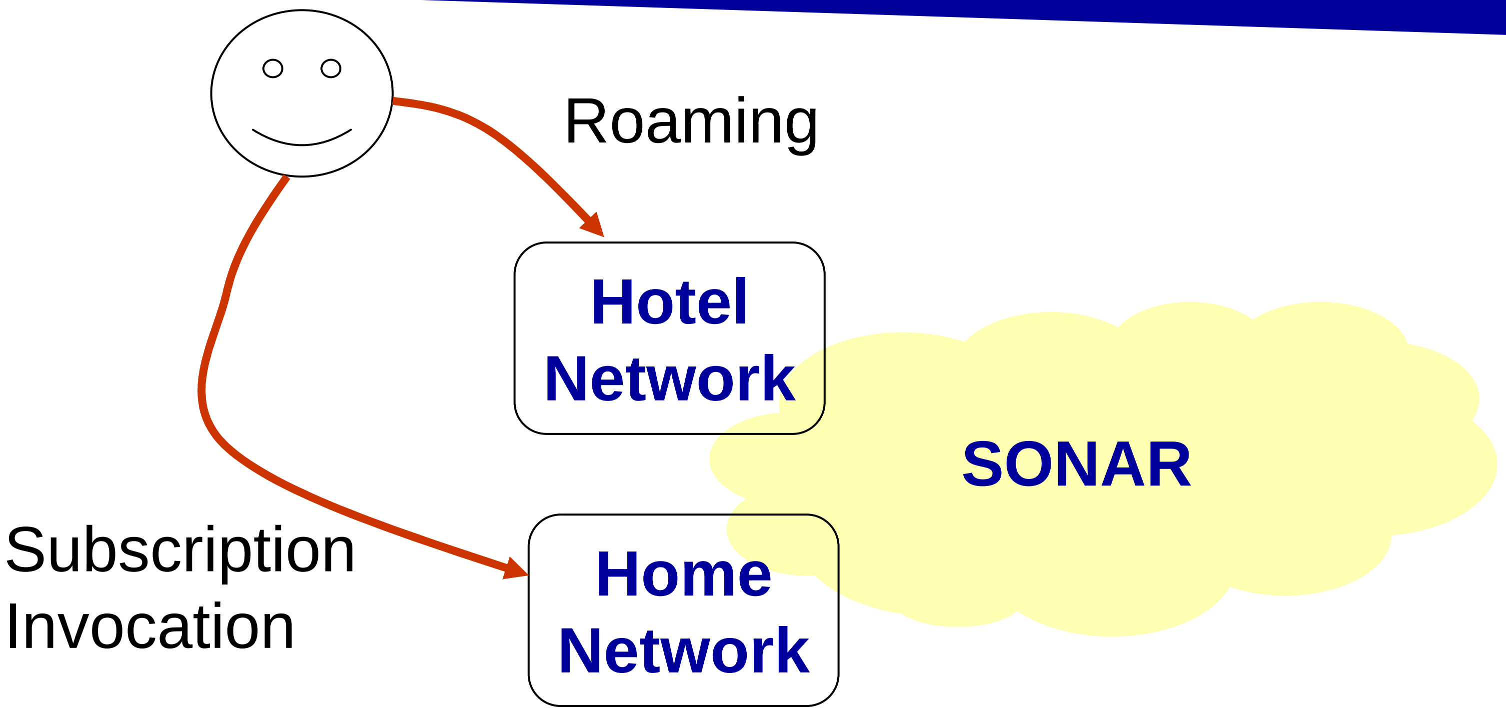
$$p(accepted) = \frac{\#lsp_{Green} + \#lsp_{Yellow}}{\#lsp_{total}}$$

- Adds extra level of service differentiation !!!
  - Same DS class
  - Different application level CAC

Components


XSL-T
TRANSLATION
Registration
SIP
Activation
XACML
Decision Process
Network Status
Network Config

Deployment Example



- SLS=set of attributes
  - Some discrete (DiffServ Classes → User Classes): eg. Residential vs. Business
  - Some cont.: e.g. time
- Roaming= define translation mechanism for SLSs
- Decision= ingress-only

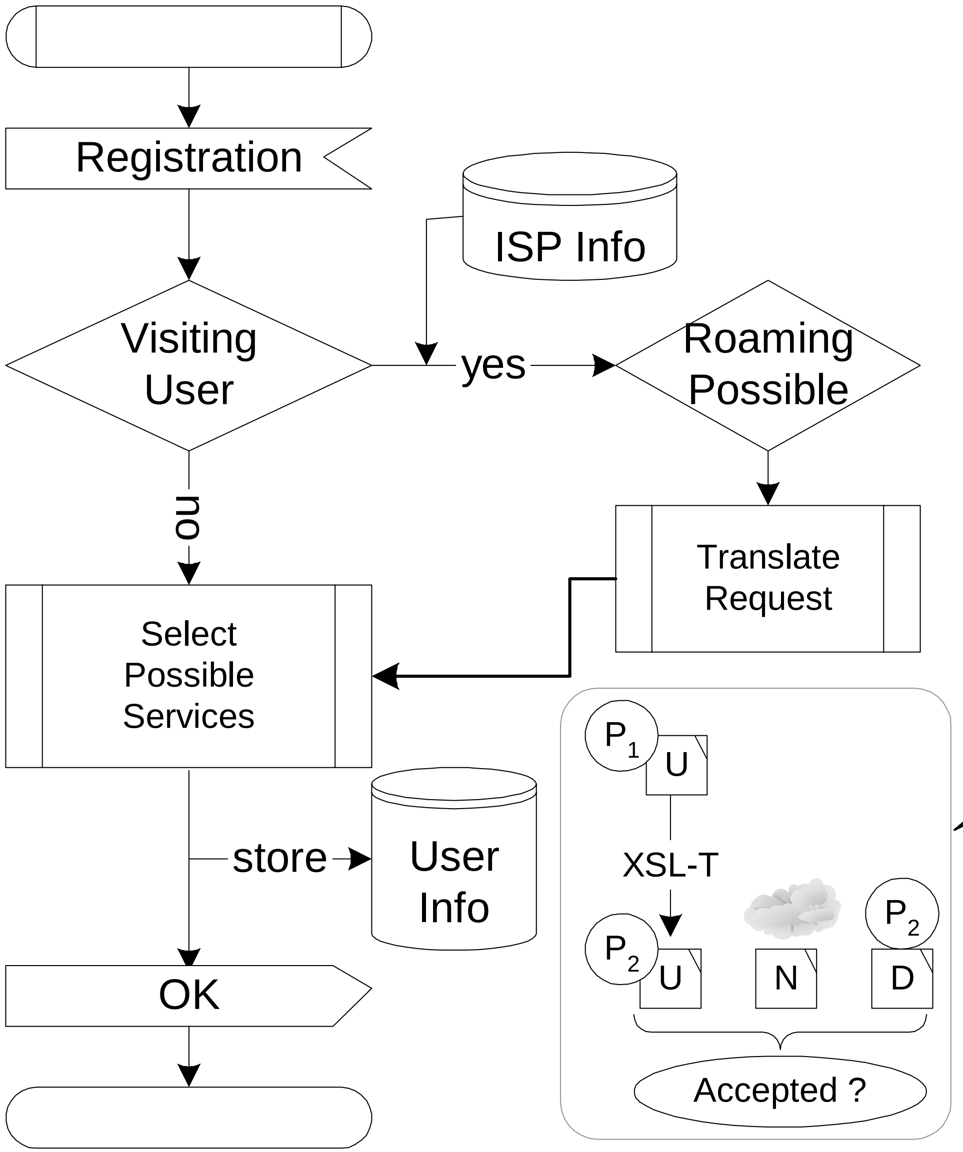
SIP as QoS-session control protocol

- SIP=well-known for IP-telephony
  - Registration of users at certain location
  - Management of sessions: create, end, …

- But: is actually more generic (similar to http)
- Sufficient for QoS-session setup

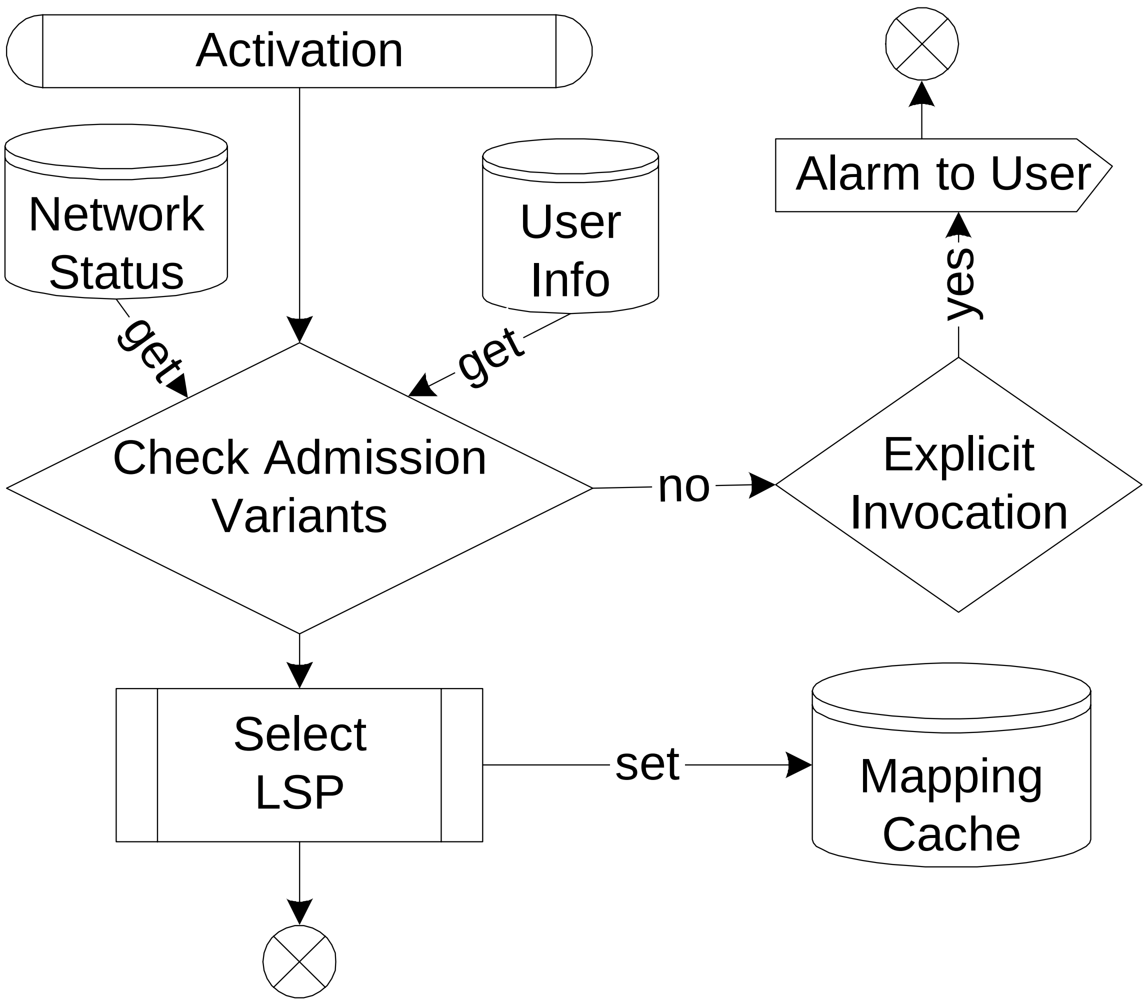
- Note: architecture allows multiple mechanisms to be present as long as mechanism is the same
  - RSVP, Web Services, ….

Registration Process



Translate Attributes between Providers

Activation Process



Conclusion

- SONAR=Adaptive Traffic Engineering Platform
  - Multiclass/multipath
  - Monitoring Feedback
- Policy-based CAC:
  - User requirements: attributes
  - Network status: environment

  User Differentiation
  Orthogonal
  To Traffic Differentiation

  - Ingress-only decision, allows roaming
- Existing technologies: XSL-T+XACML+SIP
  - Possible
  - Optimal ???
- Future work: further integration (e.g. OSGi)