

# End-to-end QoS provisioning in Grid: A Network Perspective

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# Overview of presentation

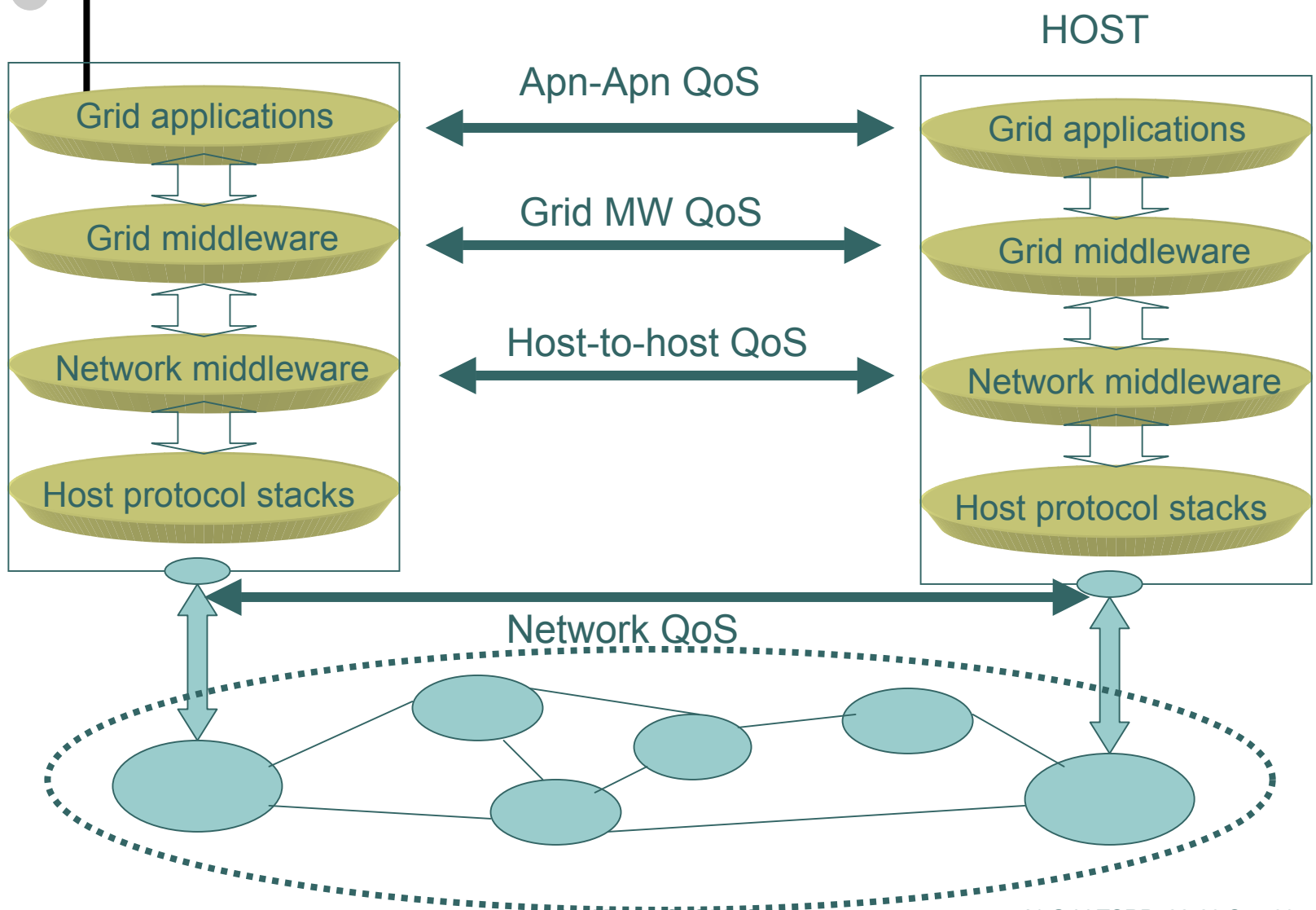
- Scope of QoS provisioning in GRID and the need for network QoS
- Why network QoS has not taken-off?
- Challenges and opportunities of R&D in network QoS
- Approaches
- QoS control and management framework (QCMF)



# Quality of service in Grid

- QoS = the collective effect of service performance which determines the degree of satisfaction of a user of the service (ITU)
- QoS is desirable in Grid (services)
- QoS in GRID =  
QoS of GRID Middleware/services &  
**QoS of Networks** (including hosts' middleware and OS)

# Scopes of QoS





# Do we still need network QoS?

- **Yes**, when over-provisioning of bandwidth is not an option (e.g. in access networks)
- Why over provisioning?
- Is over provisioning of bandwidth sustainable in core networks?
  - May be not, if Grid services get its way
- Network QoS is not new and solutions are plentiful
  - POT, ATM, IntServ, DiffServ, MPLS, QoS routing, and the more recent overlay networks



# Why network QoS is still not widely available? (1)

- Non-QoS-specific
  - Timeliness of solutions
  - Lack of business model for QoS network service
  - Assurance of network end-to-end QoS coherence in the face of multiple intervening parties
    - tussle and trust between stakeholders and users



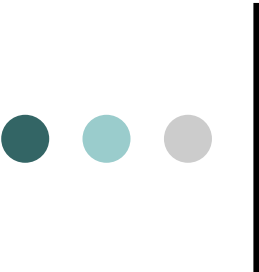
# Why network QoS is still not widely available? (2)

- QoS specific constraints:
  - lack of price based differentiation with the necessary accounting and charging architecture
  - Complexity of the QoS solution → operation management issues: reliability and ease of management, and easy to use
  - Inter-domain QoS is still a problem



# Some fundamental Issues

- Current network QoS architecture is built on BE platform
  - Fine gain QoS management is impossible,
  - No guaranteed QoS
  - Security is one of the biggest thread
- QoS solutions are still piecemeal
  - Lack of a holistic approach and integrated framework



# GRID Services: opportunities for network QoS R&D

- **“Outrageous”** – 1<sup>st</sup> principle approach
  - Re-invent a new network architecture with QoS enabled protocols
  - Eg. NewArch & TRIAD
    - <http://www.isi.edu/newarch/fara.html>
    - <http://www-dsg.stanford.edu/triad/index.html>
- **Enhancement of existing QoS solutions**
- **QoS framework approach**



# Enhancement of existing QoS provisioning

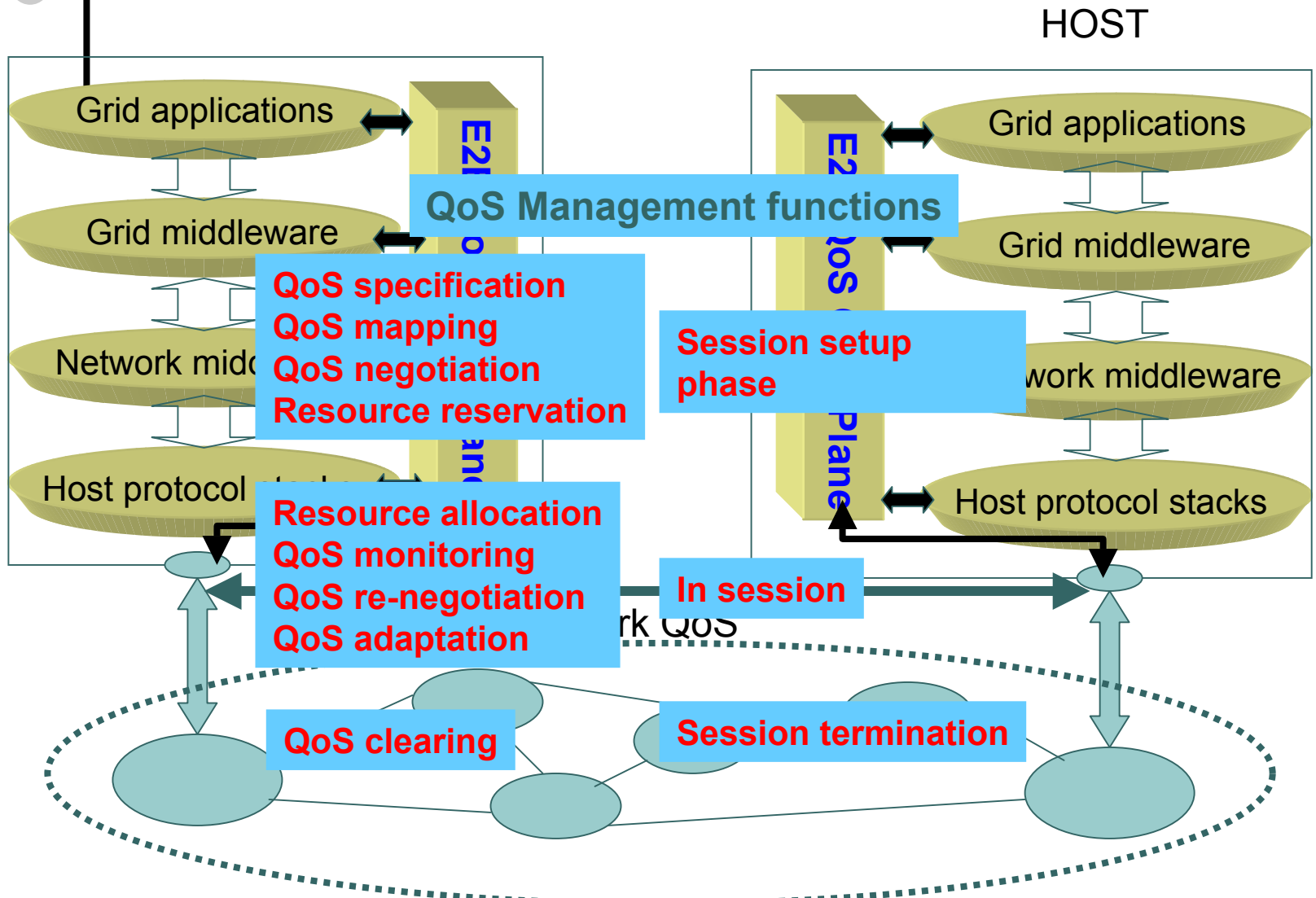
- Inter-domain QoS service (DiffServ brokers – NUS + NTU)
- QOS in IPV6/QBONE (NUS, NTU, I2R)
- Multicast QoS (NUS, NTU)
- Service differentiation through pricing (NTU)
- Policy based QoS management in DiffServ (NUS)
- QoS Routing (NUS, NTU)
- Overlay/P2P networks (NTU, NUS)
- High performance network protocols – e.g. high throughput TCP



# QoS control & management framework approach (QCMF)

- A holistic approach to the provision of QoS
- View network QoS, host's network middleware QoS, grid middleware QoS and application's QoS (if any) as QoS components (meta models)
- Each QoS component is configurable and support runtime adaptations
- Introduce e2e QoS monitoring, feedback and control signaling and decisions reasoning elements at end-hosts

# Conceptual framework of QoS C&M





# Objectives of QCMF (1)

- Integrated QoS control & management – e2e style
- Separation of QoS algorithms with QoS control & management
- Separation of control signaling path with data path
- Configurable and adaptive to changes

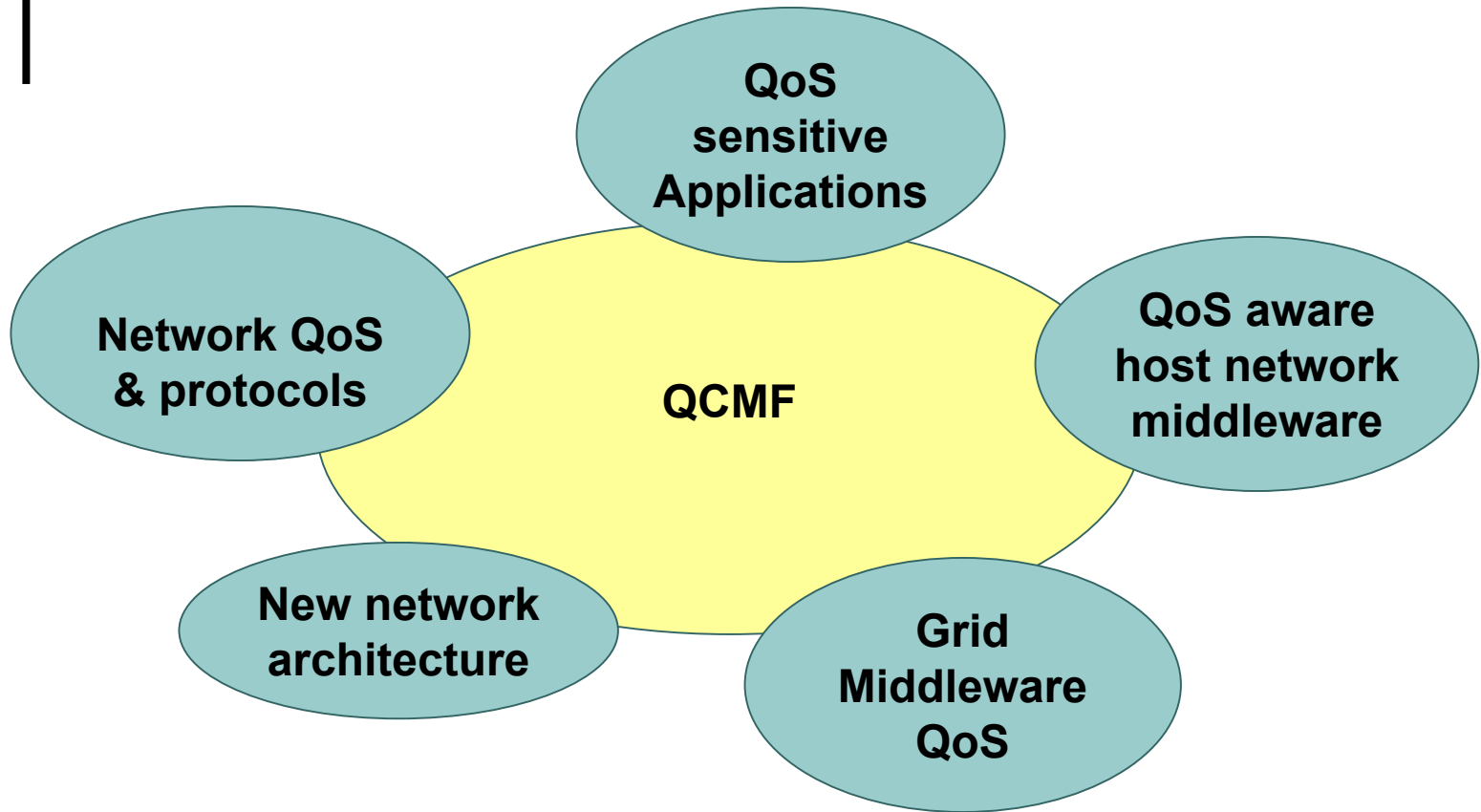


# Objectives of QCMF (2)

## Separation of QoS algorithms with QoS control & management

- QoS control management functions
  - Service agreement, QoS requirements
  - QoS Monitoring
  - Adaptation rules/policy & interpretations
  - Signaling
- QoS algorithms/methods
  - Resource reservation and allocation
  - Access control, security, accounting & billing
  - Admission control, policing, and scheduling
  - Traffic shaping, buffer management and etc

# QCMF & Others





# Conclusion

- QoS is particularly important in utility Grid services
- Utility grid provides a new opportunity to further R&D in network QoS
- QoS itself has to be an utility to users\*
- A holistic QoS control and management framework would be useful.