To Session or not to Session
Session Concepts in Currently Emerging Future Networks

{marc.necker | michael.scharf}@ikr.uni-stuttgart.de

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Outline:
• To session in general
• Pros and cons of sessioning
• To session in particular
Traditional Network Design Principles

Internet

- End-to-end argument: Intelligence is located in the end-nodes
- ISP provides bitpipe only
- Open to many new services
  ➗ User centric design

Telecommunication networks

- Operator control: Intelligence is located in the network
- Closed network, usage-based charging
- Well-standardized services
  ➗ Operator driven / network centric
Current Trends

All-IP Networks ...
Current Trends

All-IP Networks ... Under Full Operator Control

NGN architectures of 3GPP, ETSI, and ITU-T: IP Multimedia Subsystem (IMS), TISPAN, ...

- xDSL
- GSM, UMTS, 3GPP LTE
- WLAN, WiMax
- PSTN
- Other operator

Institute of Communication Networks and Computer Engineering
University of Stuttgart
All-IP Networks ... Under Full Operator Control?

NGN architectures of 3GPP, ETSI, and ITU-T: IP Multimedia Subsystem (IMS), TISPAN, ...

Current Trends
From Session to State
From Session to State
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State semantics
From Session to State

State semantics

existence
properties
requirements
From Session to State

State semantics

Functionality of network element

existence
properties
requirements
detection
measurement
State semantics

Functionality of network element

e.g. QoS scheduling

detection
measurement
diff. treatment

existence
properties
requirements

From Session to State
From Session to State

State semantics

Functionality of network element

existence
properties
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detection
measurement
diff. treatment
modification
From Session to State

State semantics

Functionality of network element

- detection
- measurement
- diff. treatment
- modification
- termination

existence

properties

requirements
From Session to State

State semantics

- existence
- properties
- requirements

Functionality of network element

- detection
- measurement
- diff. treatment
- modification
- termination
Lifeline of Network State
Lifeline of Network State

- Creation
  - Authentication
  - Authorization
  - Signaling
  - Resource Allocation

- Existence

- Update
  - State-aware operations

- Existence

- Teardown
  - Signaling
  - Resource deallocation
Lifeline of Network State
Pros and Cons of State in the Network

Advantages
- Per-session QoS
- Availability Resilience
- Network-triggered actions
- Mobility
- Usage-based accounting and charging

Problems
- Scalability
- Consistency Synchronization
- Error handling
- Integrity Authentication
- Inter-domain operation

 activates Reasons beyond QoS!
Mobility Management

- Mobile IP: End-to-end solution
Mobility Management

- Mobile IP: End-to-end solution
- Cellular networks: Highly stateful

Resource Management

- Challenge: Common resource management for heterogeneous networks
- Needs to be network driven, or at least network assisted
  ➔ Optimal resource management requires session information

Research Issues

- Architectures and protocols for holistic resource management
- Mobility management across heterogeneous access networks
- Cross-layer indications (e.g., for adaptive applications)
Distributed Denial-of-Service Attacks (DDoS)

- Serious problem in today’s Internet
- DDoS countermeasures
  1. Massive overprovisioning and replication (e.g., content delivery networks)
  2. Protection by packet filters and firewalls
- Possible solution: Per-flow access control by firewalls
  - Packet filters or firewalls at domain boundaries
  - Blacklist or whitelist approach possible

Research Issues

- Interaction with session signaling protocols (e.g., SIP)
- "Path-coupled" vs. "path-decoupled" firewall signaling
Problem 1: Topology Hiding

- Non-disclosure of internal network details
- Requirement by operators
- Signaling filtering
- Research issue: Interdomain-operation with limited knowledge
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Problem 2: User Location Privacy

- Hiding of sensible user data (e.g., IP address)
- Address mapping, e.g., by network address port translation (NAPT), JAP
- Requires session state at intermediary anonymizers
- "Feature": May prevent end-to-end communication by users (P2P)
- Research issue: Interworking with end-to-end protocols
Problem 3: Anonymity

- **Usual trust model:** Network operator is fully trusted
  - But: Aggregation of knowledge at operator raises privacy issues
  - More and more operators and service providers
  - Internet does not only span democratic countries
- **Anonymity can be achieved by encryption and multiple anonymizers**

- Information is encoded in packets, no state in anonymizers
- Research issue: Preventing inference by cooperation, ...

➤ Protection of user *against network operator*
Future Generation Networks

The Raise of ...

- IP-based core network
- xDSL
- GSM, UMTS
- 3GPP LTE
- WLAN
- Wimax
- Subscriber database
- Application servers
- PSTN
- GW
- Other operator
- Different administrative domains
- Control plane

Different administrative domains
The Rise of Session Border Controllers (SBC)

Future Generation Networks

- Signaling filter
- NAPT and firewall
- Transcoding

Control plane

Different administrative domains

IP-based core network

Subscriber database

Application servers

CSCF

xDSL

GSM, UMTS 3GPP LTE

WLAN WiMax

PSTN

Other operator

Subscriber database

Application servers

CSCF

CSCF

CSCF

GW

SBC

SBC

SBC

SBC
The Raise of Session Border Controllers (SBC)?

IMS/TISPAN/... as "one-does-it-all" solution?

- Signaling filter
- NAPT and firewall
- Transcoding

Future Generation Networks
Conclusion

"Usefulness"

Future Generation Networks?

Internet today

Arpanet

IMS/TISPAN?

BISDN/ATM

Amount of state and signaling

Complexity