DDS/SIP Interworking: A DDS-SIP Gateway

Jose M. Lopez-Vega

Javier Povedano-Molina
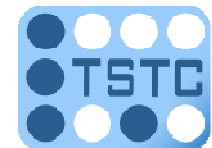
Juan M. Lopez-Soler

{**jmlvega, jpovedano, juanma**} @ugr.es
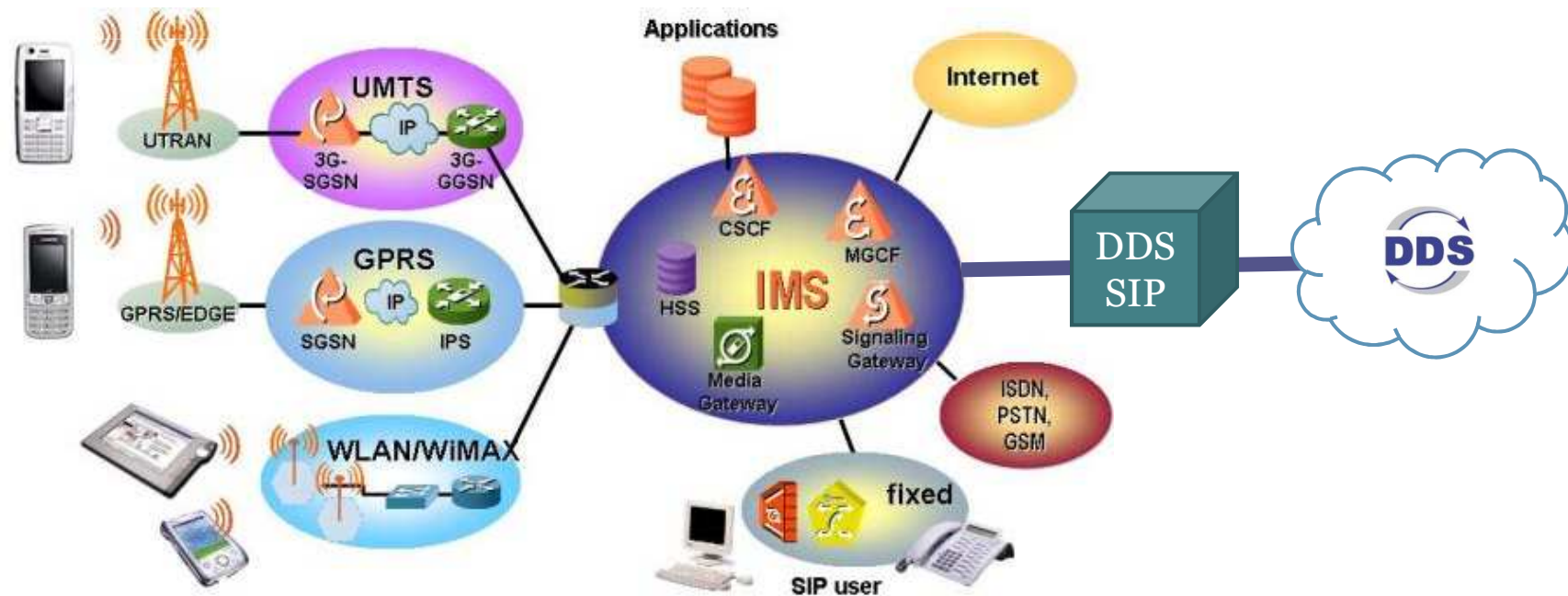
Universidad de Granada

Motivation

- Integrating DDS with the IMS (Internet Mobile Subsystem)

Outline

1. **The Challenge**
   - Use cases
2. Basic Concepts
   - SIP (Session Initiation Protocol)
   - The IMS (IP Multimedia Subsystem)
   - The RCS (Rich Communication Suite)
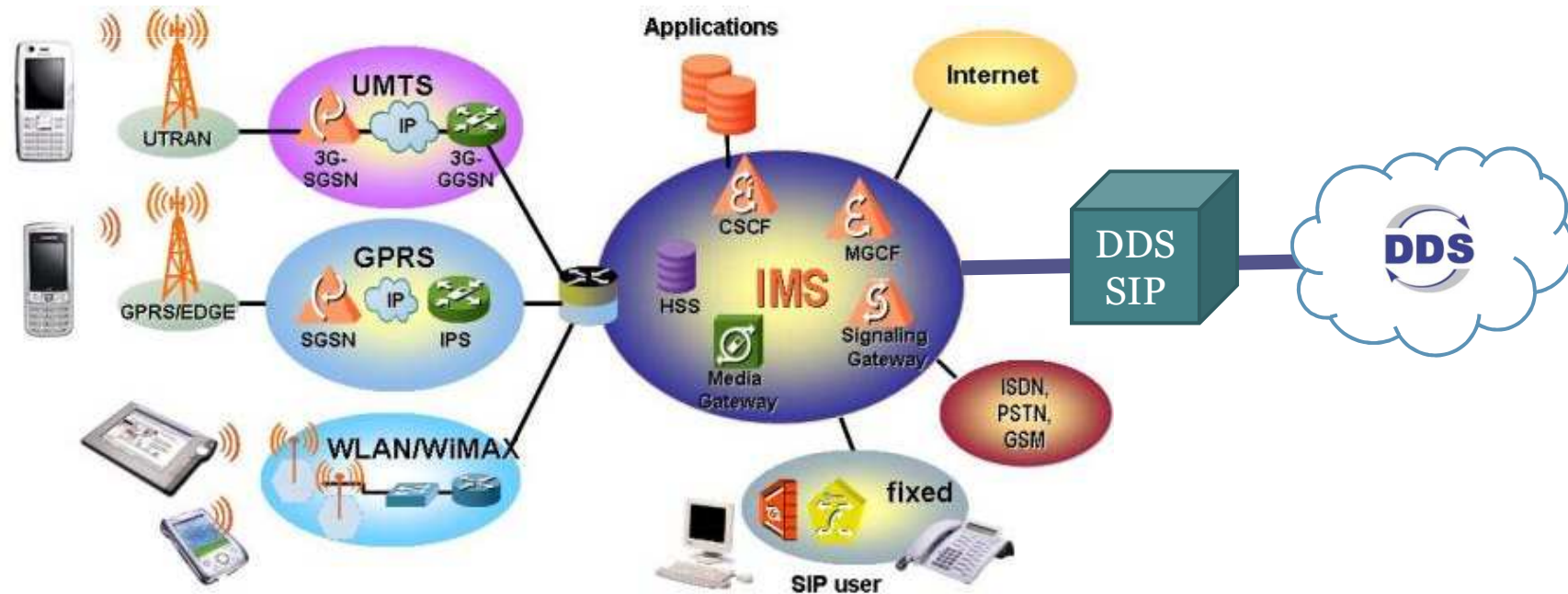   - DDS over the WAN and the IMS
3. Proposed Design
   - Advantages of using SIP
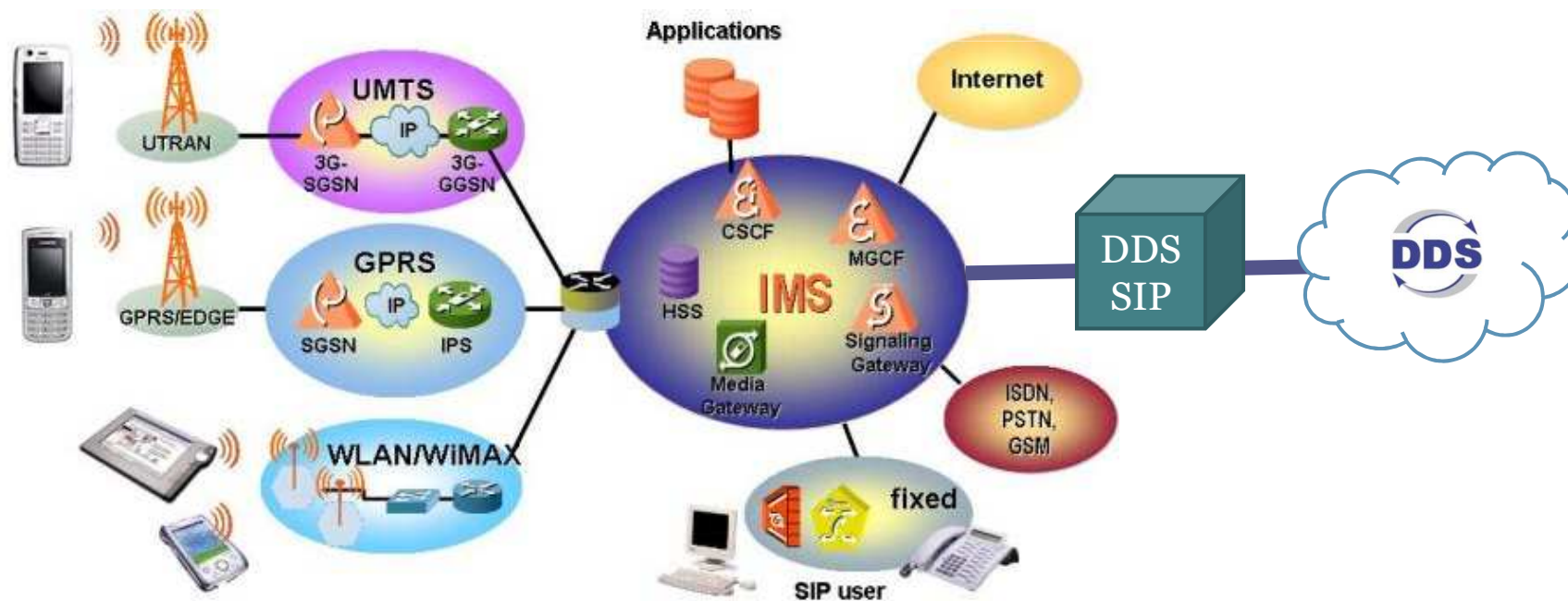   - Proposed Architecture
4. Conclusions

The Challenge

The Challenge

- Integrating DDS with the IMS (Internet Mobile Subsystem)
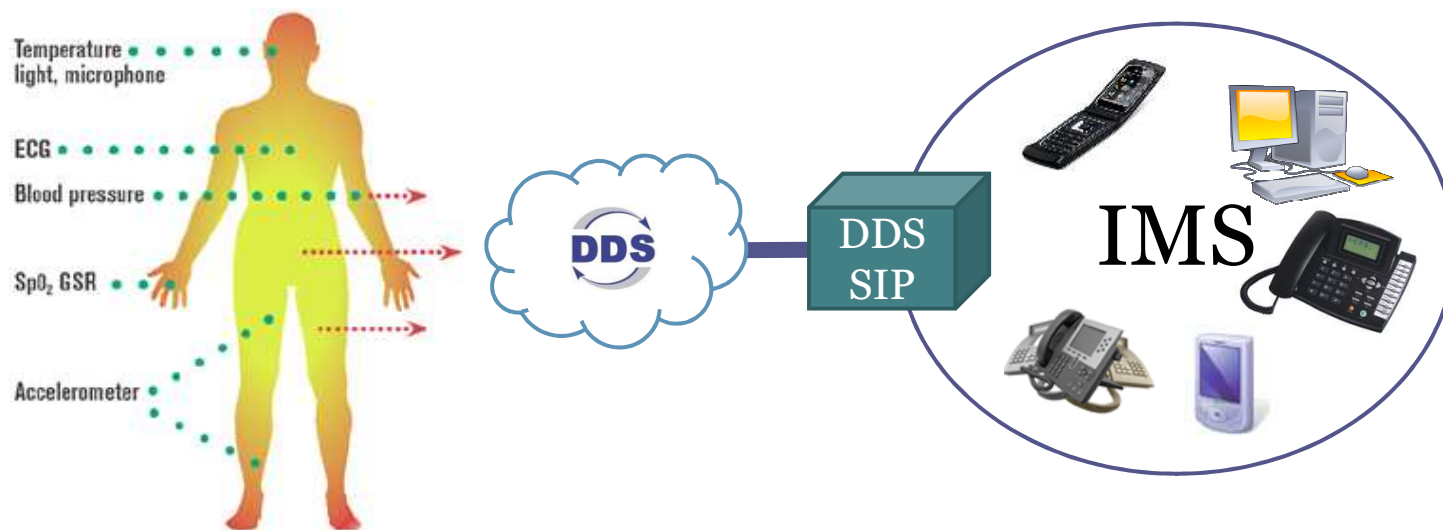
The Challenge

- The integration of IMS and DDS will open up a number of new possibilities

The Challenge - Use cases

- ## Medicine
  - The vital signs of a patient can be published through DDS Topics
  - When one of the readings is not normal, the nurse is notified through its currently active SIP device

The Challenge - Use cases

- Financial market
  - Share prizes can be published through DDS Topics
  - When a given share prize reaches certain value, the user is notified through its currently active SIP device
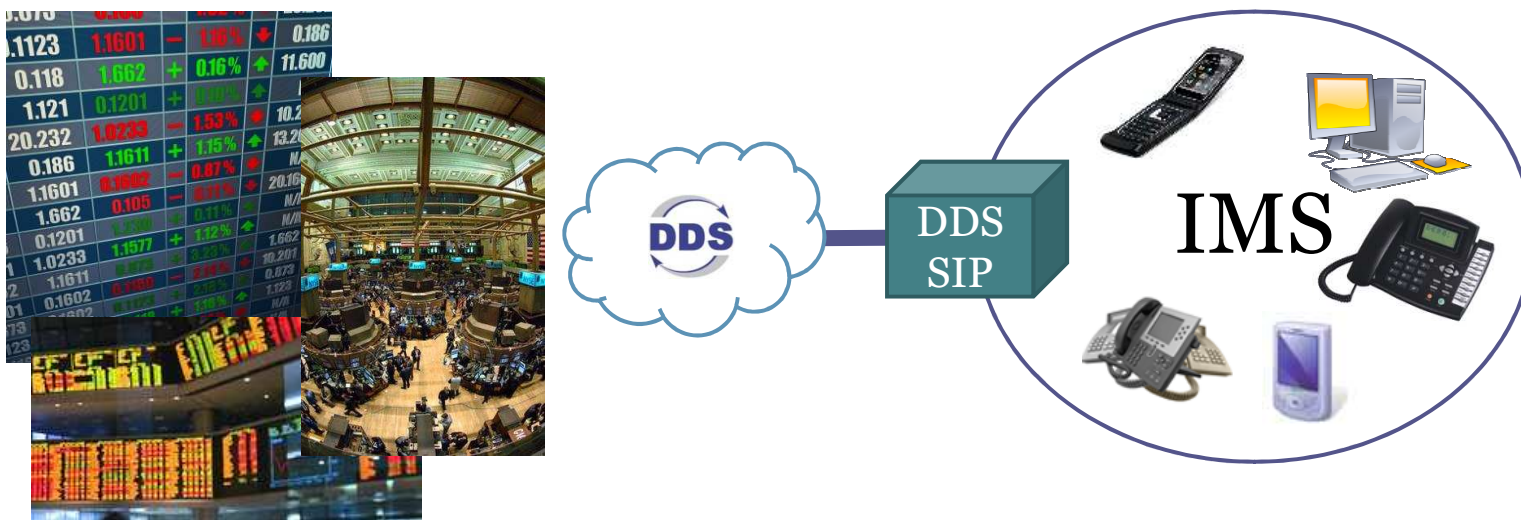
The Challenge - Use cases

- Connecting two remote DDS Domains
  - ▫ Two remote offices can establish a channel through the WAN or the IMS
  - ▫ This channel will be used for sharing its DDS domains
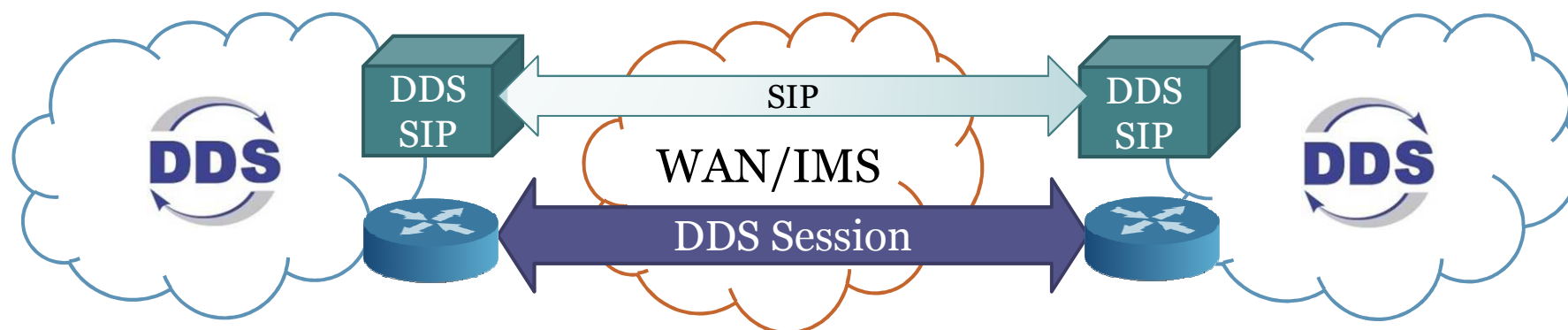
The Challenge

- This integration requires the design of proper DDS-SIP gateways
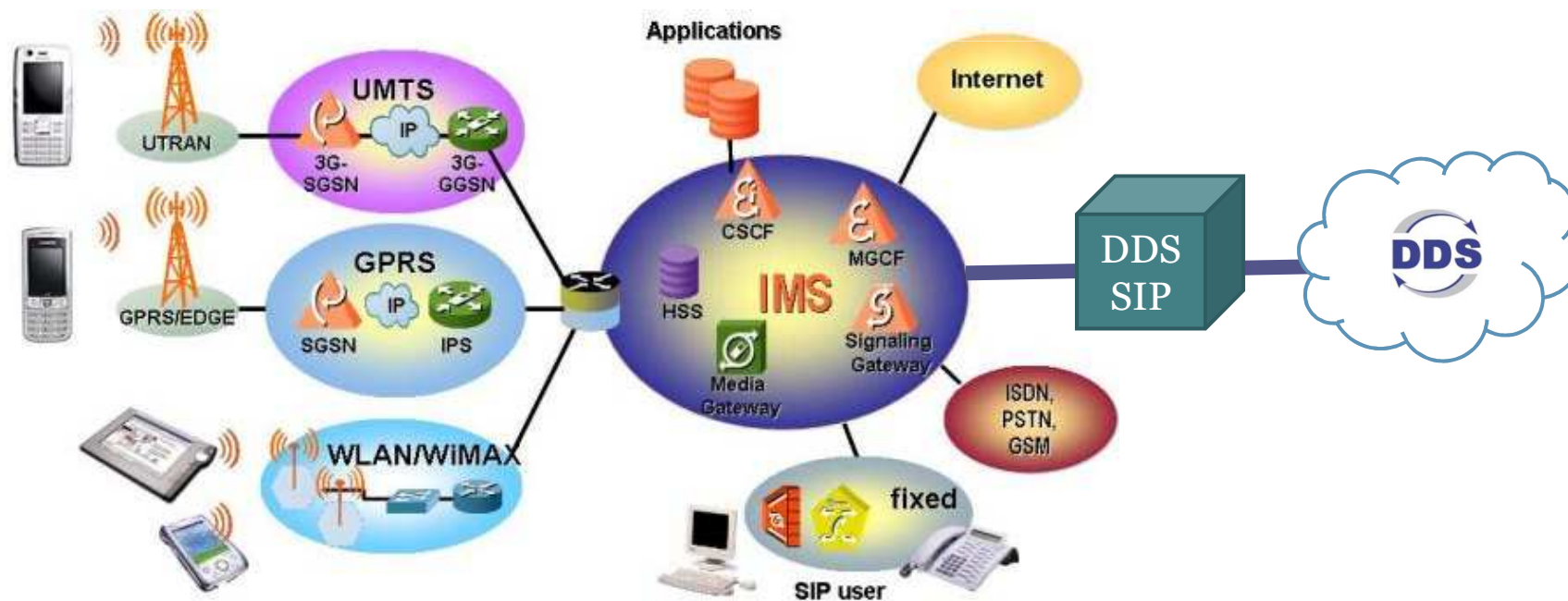
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Basic Concepts

SIP (Session Initiation Protocol)

- SIP is a standard of the IETF, defined in the RFC3261 and several extensions
- SIP is becoming the *de-facto* standard for VoIP deployments in fixed and wireless networks.
- The mission of SIP protocol is to establish, maintain, change and terminate multimedia sessions among remote peers.

SIP (Session Initiation Protocol)

- SIP is an endpoint-to-endpoint signaling protocol
- SIP is a text-based, application protocol
- SIP syntax is similar to HTTP/1.1
- SIP can use MIME within the body message

SIP (Session Initiation Protocol)

```
INVITE sip:bob@biloxi.com SIP/2.0
Via: SIP/2.0/UDP pc33.atlanta.com;branch=z9hG4bK776asdhds
Max-Forwards: 70
To: Bob sip:bob@biloxi.com
From: Alice <sip:alice@atlanta.com>;tag=1928301774
Call-ID: a84b4c76e66710@pc33.atlanta.com
CSeq: 314159 INVITE
Contact: sip:alice@pc33.atlanta.com
Content-Type: application/sdp
Content-Length: 142
```

SIP (Session Initiation Protocol)

- SIP basic methods
  - **REGISTER**: Used by a UA to notify its current IP address and URLs.
  - **INVITE**: Used to establish a media session among user agents.
  - **ACK**: Confirms reliable message exchanges.
  - **CANCEL**: Terminates a pending request.
  - **BYE**: Terminates a session.
  - **OPTIONS**: Requests information about the capabilities of a caller.

SIP (Session Initiation Protocol)

- SIP constitutes the main element of the signaling plane in the IMS
  - ▫ SIP performs the session control of the IMS
- SIP eases the addition of new services to the IMS.

The IMS (IP Multimedia Subsystem)

- Third Generation (3G) networks are merging two of the most successful paradigms in communications
  - Cellular networks
  - Internet
- The IMS is the key element in 3G
  - It provides ubiquitous access to all the services that the Internet offers

The IMS (IP Multimedia Subsystem)

- All the power of Internet is already available for 3G users, right?
- Why do we need IMS?
  - QoS
  - User and application mobility
  - Integration of rich communication services

The IMS (IP Multimedia Subsystem)

- Is the IMS been used somewhere?
- Yes, in the RCS (Rich Communication Suite)
- But... what is the RCS?

The RCS (Rich Communication Suite)

- The RCS Project is a collaborative effort to speed up and facilitate the introduction of IMS
- Defines a common vision on delivering convergent, rich communication services.
- RCS fits the lifestyle communication needs of the 'always-on' users
  - RCS is the starting point for user social interaction
  - It will make multimedia social networking simpler

RCS – The facts

- Currently supported by over 80 leading companies including 28 of the world's top operators
  - This represents approximately **1.8 billion global connections**.

RCS – The facts

- RCS has the support of more than 50 leading vendors of handsets, infrastructure and applications

RCS – The facts

- On September 7th, 2009 a technical specification for value-added IMS network services was successfully tested
- This framework eases the integration of new services to the IMS

DDS over the WAN and the IMS

- ## DDS Routing Service
  - ▫ Spatially decouples DDS entities over the WAN
  - ▫ Does not resolve the problem of NAT/firewall traversal
- ## DDS WAN Service
  - ▫ Allows NAT traversal using STUN
- ## DDS-WS
  - ▫ A Web services – DDS gateway has been proposed
  - ▫ Web services rely on HTTP

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Proposed Design

Proposed Design

- We define the concept of DDS session
    - A DDS session is a logic channel that connects two remote DDS Domains
    - The DDS session is established using SIP signaling
    - SIP can negotiate (using SDP) the parameters of the session
        - QoS policies
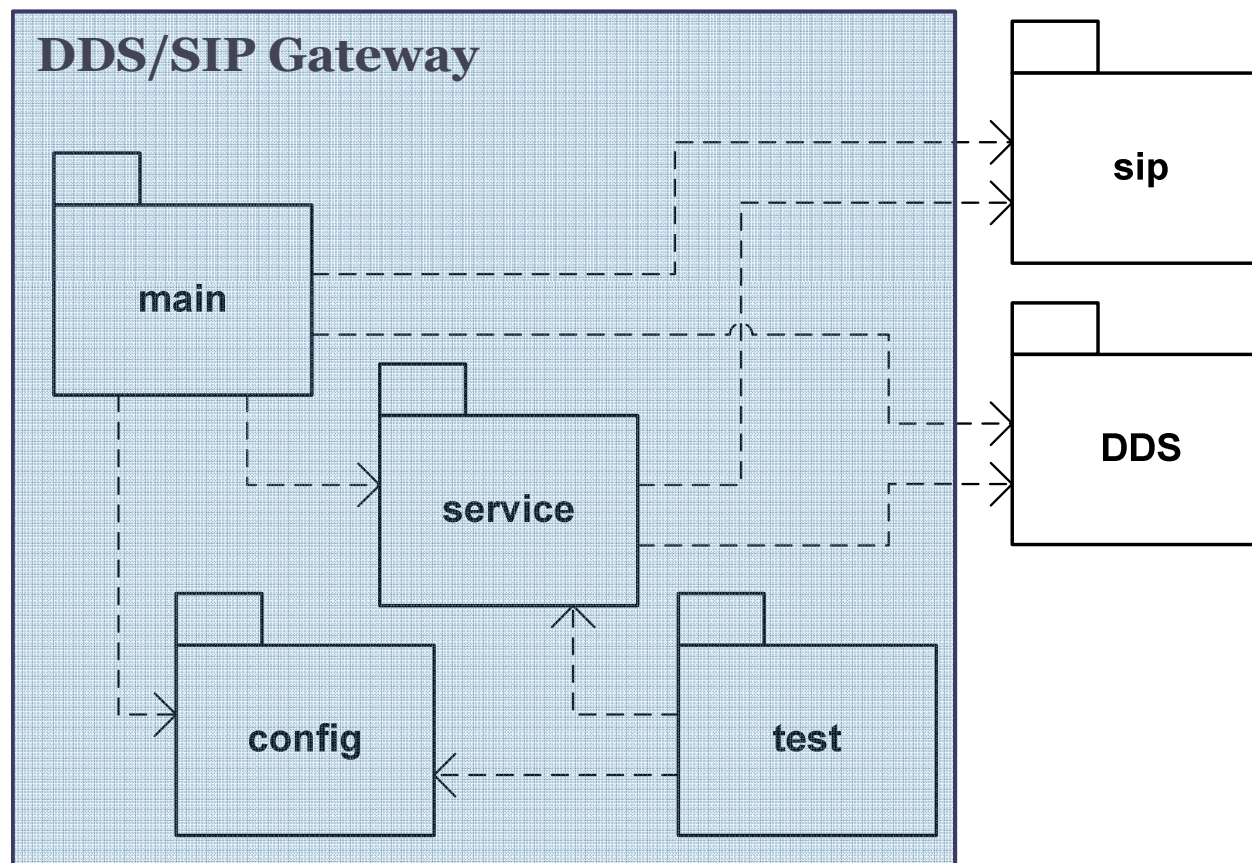   - Topics to be shared
        - Maximum sample rate
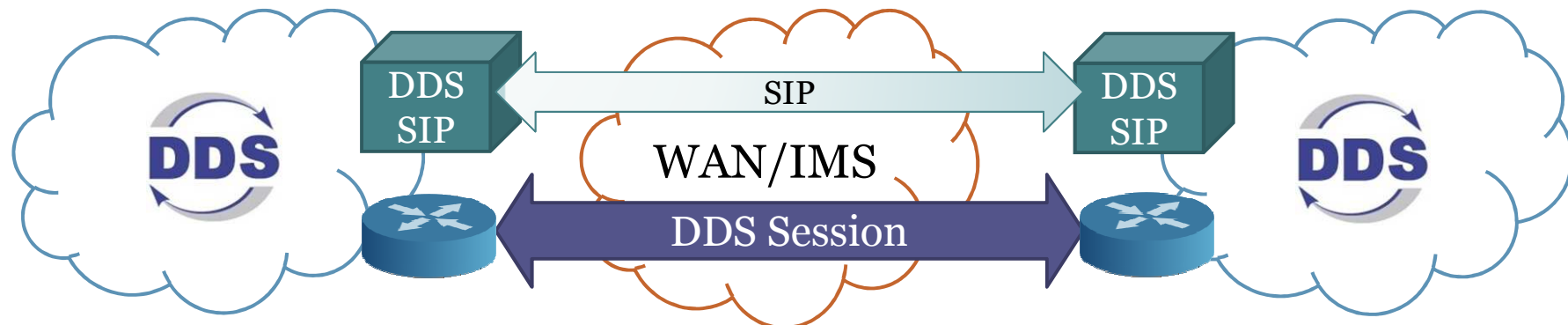
Proposed Design

- The proposed DDS-SIP gateway will have three objectives
  - To provide interoperability with SIP devices
    - Sending SMS with a summary of certain Topic values, or the Topic history
    - SIP devices will be able to update DDS Topics
  - The delivery of discovery information using SIP
  - The management of DDS sessions between two remote DDS Domains
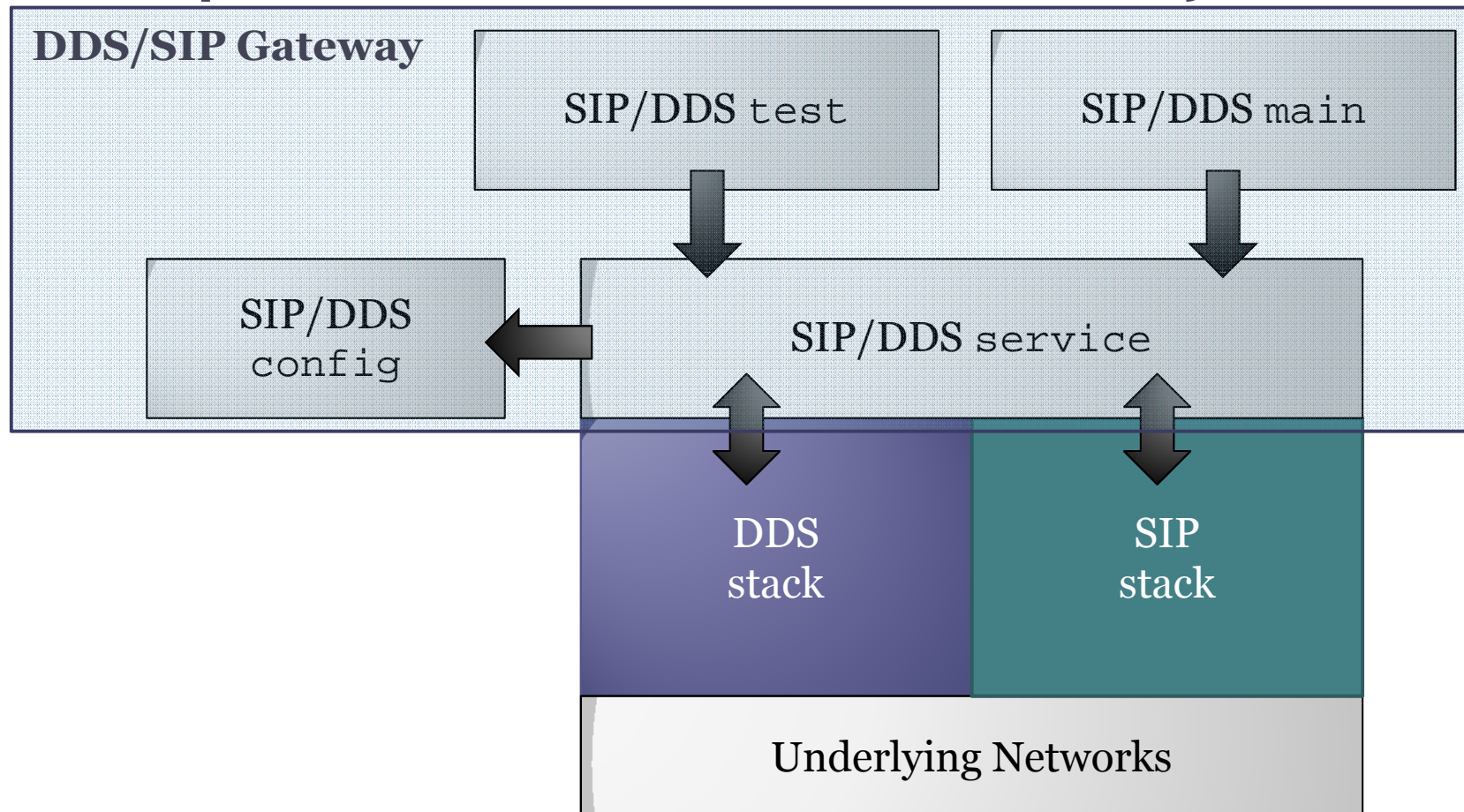
Benefits of using SIP

- SIP is a standardized solution
  - There are a lot of compatible devices and software
  - SIP is the base of the Rich Communication Suite
  - The DDS-SIP gateway will allow DDS domains to be easily integrated in IMS
- SIP is scalable and easy to implement
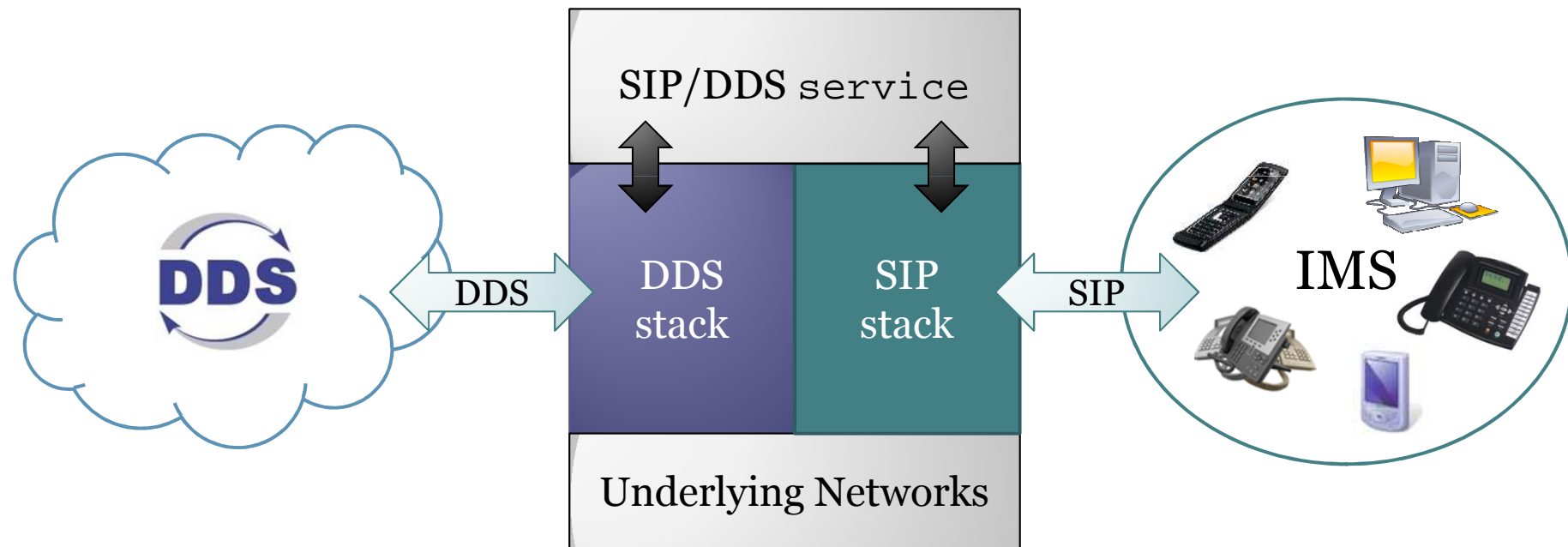- SIP resolves mobility and supports users with multiple devices

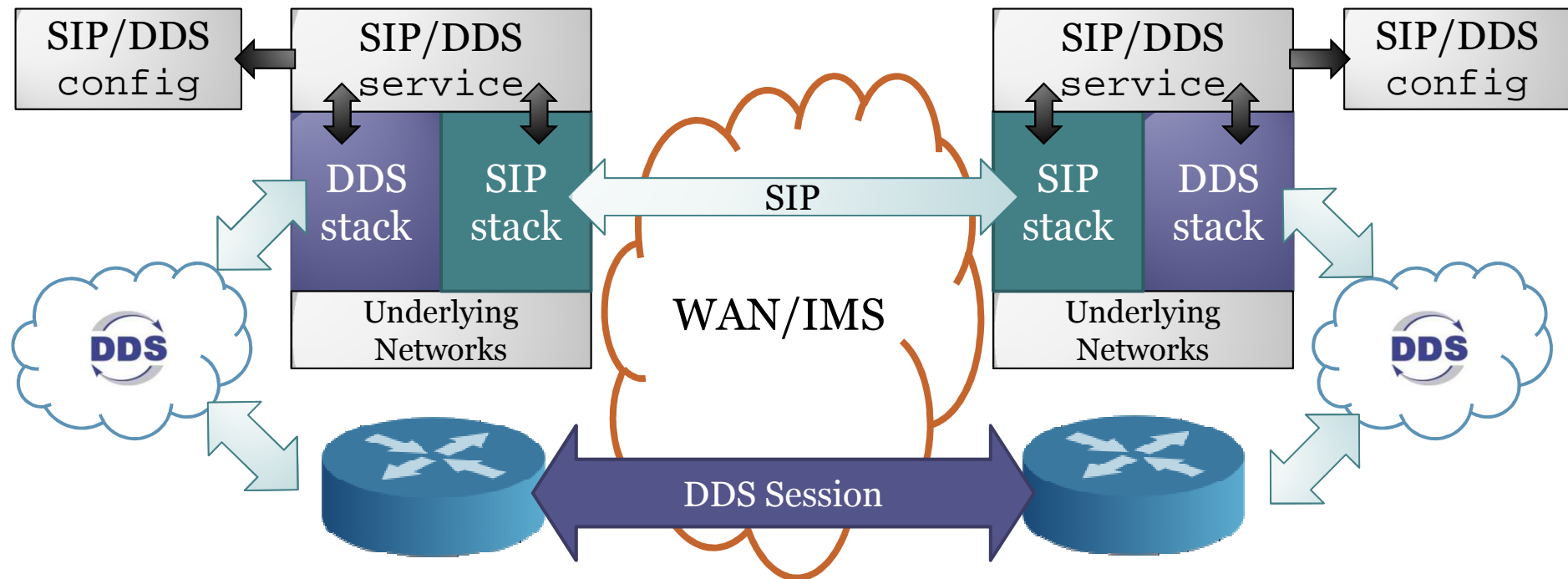# Proposed Architecture – Static Diagram

Proposed Architecture – Layers

DDS/SIP Gateway

SIP/DDS `test`

SIP/DDS `main`

SIP/DDS `config`

SIP/DDS `service`

DDS stack

SIP stack

Underlying Networks
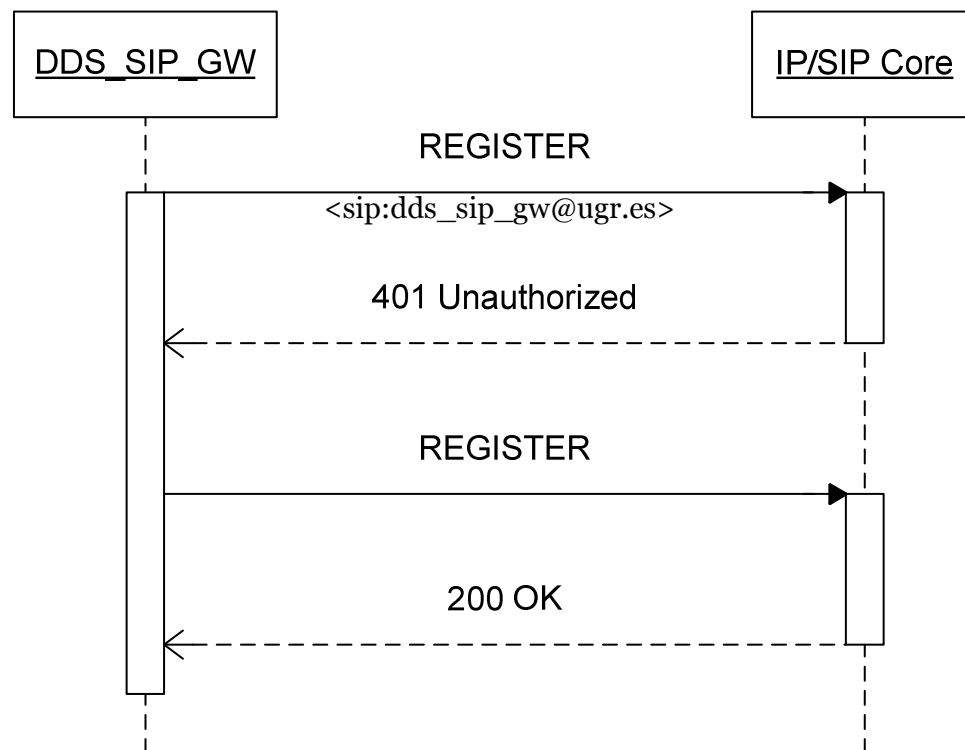
Proposed Architecture – DDS/IMS

Proposed Architecture – DDS Session

Sequence Diagrams

- The following slides contain sequence diagrams for main use cases of the SIP/DDS gateway
  - **Registering the Gateway**
  - DDS Session Management
    - Starting a DDS Session
    - Subscription for Remote Discovery
  - DDS and SIP Devices Interoperability
    - Sending Message
    - Topic Updating

Registering the DDS-SIP Gateway

- A REGISTER SIP message is sent
- SIP/IP Core may request the GW to authenticate itself
- The DDS/SIP GW shall resend the SIP REGISTER request with authentication credentials.
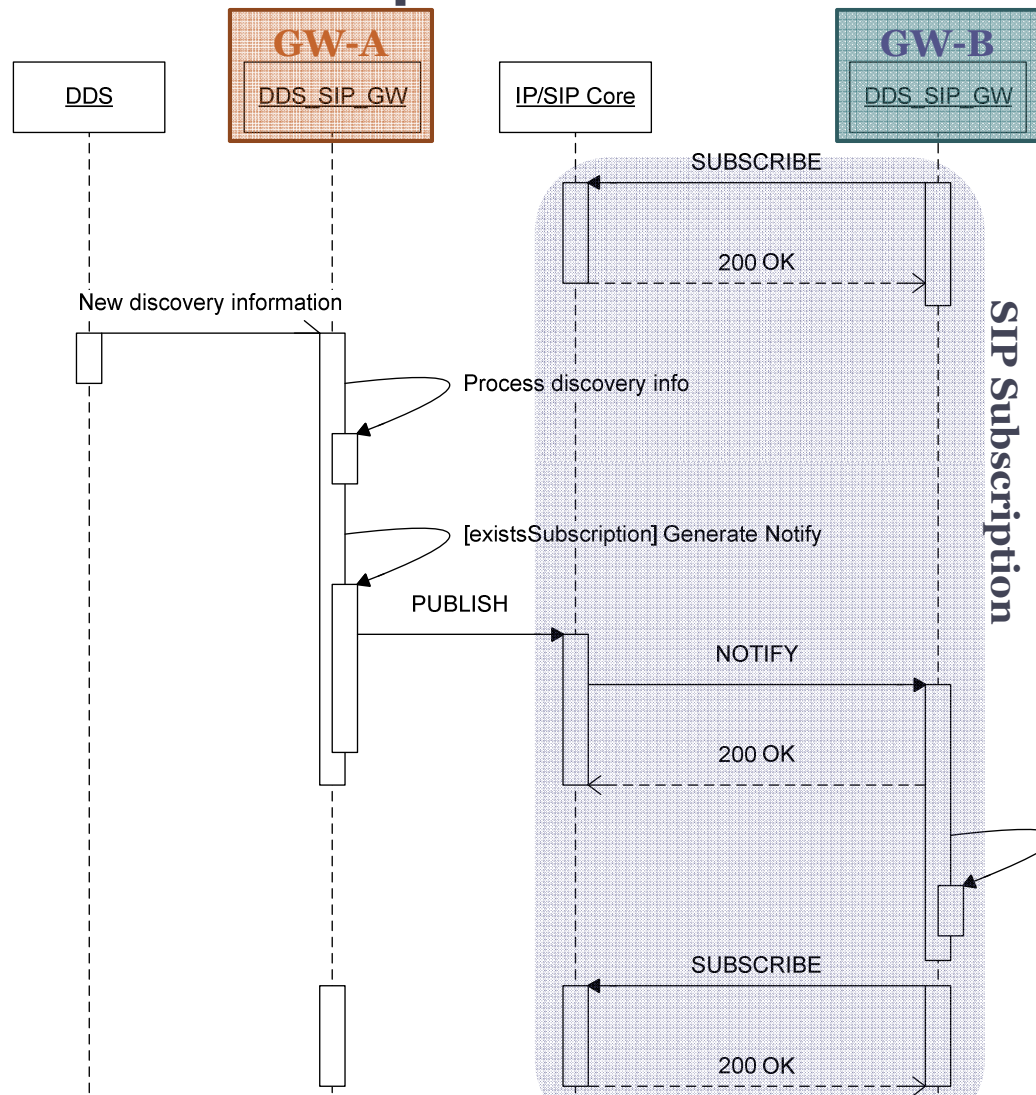
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Start DDS Session
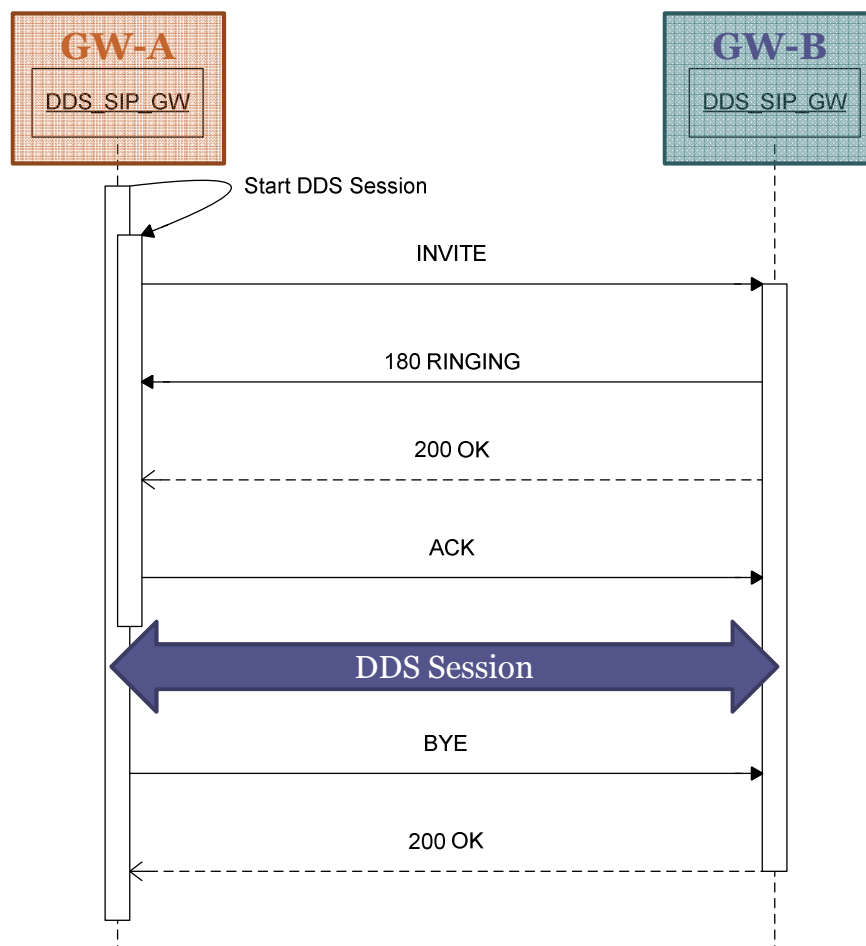
- In order to initiate a DDS Session, **GW-A** sends an INVITE SIP message to **GW-B**
- **GW-B** will answer with a RINGING message
- Once **GW-B** is ready, sends a 200 OK message to **GW-A**
- Finally, **GW-A** sends a ACK message and the DDS Session is established

Subscription for Remote Discovery

- A DDS-SIP Gateway (**GW-A**) can SUBSCRIBE to the discovery information obtained in a remote DDS-SIP Gateway (**GW-B**)
- If a DDS entity is discovered in **GW-B**, this gateway sends a SIP_PUBLISH message to the network.
- Finally, a notification is sent to **GW-A**
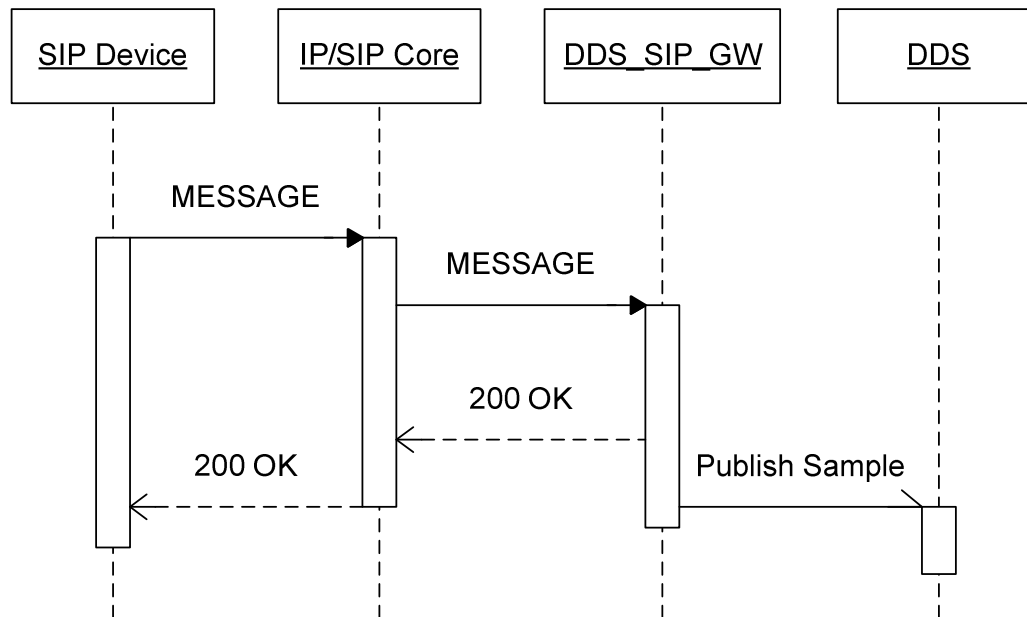
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    - Starting a DDS Session
    - Subscription for Remote Discovery
  - **DDS and SIP Devices Interoperability**
    - **Sending Message**
    - **Topic Updating**

Sharing DDS Topics with SIP devices
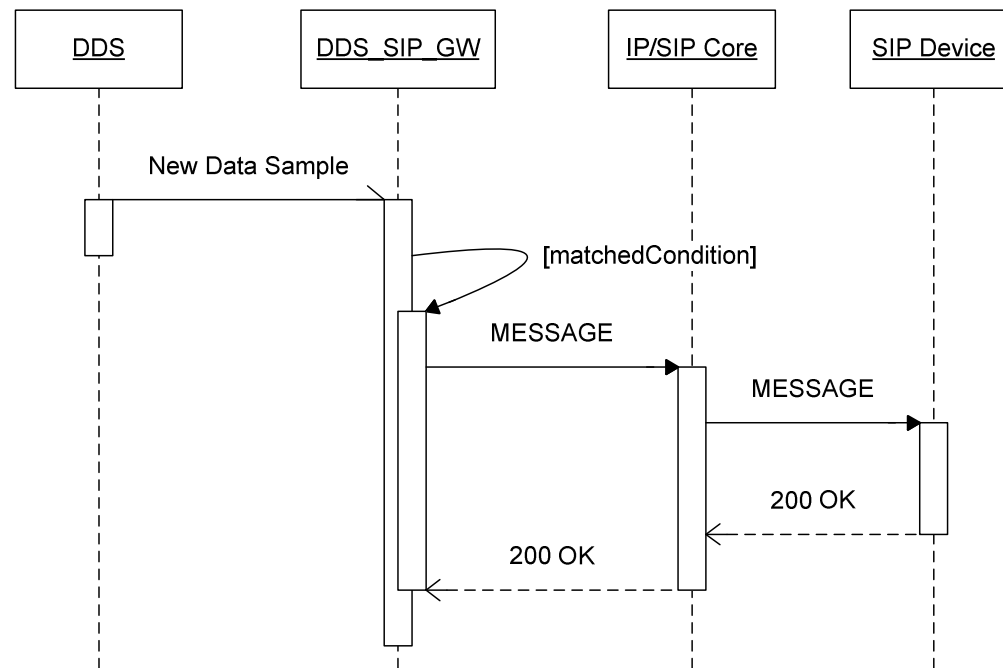
- This use case allows the DDS SIP gateway to share DDS Topics updates with any compatible SIP device.
- A message is sent after a condition is met
- This message can contain a summary of certain Topic values, or the Topic history

Diagram labels:

DDS   DDS_SIP_GW   IP/SIP Core   SIP Device

New Data Sample

[matchedCondition]

MESSAGE

MESSAGE

200 OK

200 OK

Topic Updating from a SIP device

- A SIP device (mobile, fixed or software) can update a Topic
- A SIP message is sent to the DDS/SIP gateway
- The gateway updates the Topic in a given data-space

Conclusions

Conclusions

- The future of mobile communications lies in the IMS (Internet Mobile Subsystem)
- SIP (Session Initiation Protocol) is the chosen protocol for the signaling plane of the IMS
- We have proposed a DDS/SIP gateway as a first step for DDS and IMS integration
- The proposed gateway will be able to establish and maintain the communication of two remote Domain
- Our proposal will enable SIP devices/DDS domain interoperability

Acknowledgment

Questions?