

# Middleware Solution for What Problem?

Cees de Laat

Faculty of Physics and Astronomy



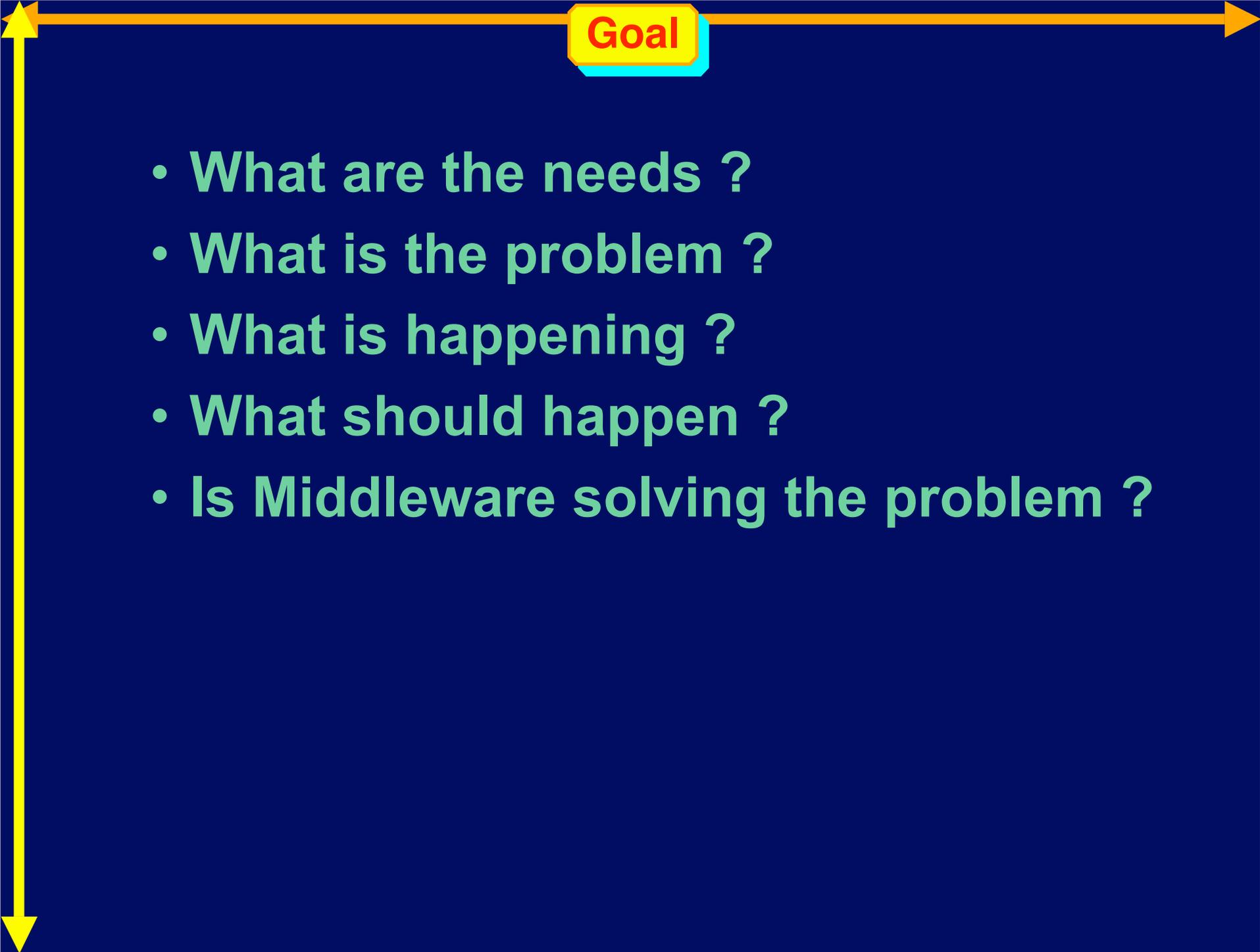
Utrecht University

## Contents of this presentation

- **This page is intentionally left blank**
  - because I found myself in a lot of chaotic thinking processes when preparing this presentation. So this talk is chaotic contrary to my nature of building presentations.

## Disclaimer

- **You are not going to like this presentation**
  - Way too many bullets
  - Almost only text
  - No nice pictures
  - No usual visual jokes
  - It is not complete
  - You may disagree with the contents



## Goal

- What are the needs ?
- What is the problem ?
- What is happening ?
- What should happen ?
- Is Middleware solving the problem ?

## What are the needs?

- Use remote resources to accomplish a task
  - Computation
  - Visualization
  - Information retrieval
  - Experimentation
  - Collaboration support
  - Multimedia distribution
- Most importantly:  
    use combinations of resources

## Different perspectives

- **Service perspective:**
  - Who is it who wants to use my resource
    - » Establish security context
  - Do I allow him to access my resource
    - » Create a capability / ticket / authorization
  - Can I track the usage of the resource
    - » Based on type of request (policy) track the usage
- **User perspective**
  - Where do I find this or that service
  - What am I allowed to do
  - What do I need to do to get authorization
  - What does it cost
- **Intermediaries perspective**
  - Service creation
  - Brokerage / portals
- **Organizational perspective**
  - What do I allow my people to do
  - Contractual relationships (SLA's)



## What is the problem ?

- Network layer programming is difficult
  - asynchronous, interrupts, real-time like
- Expertise from the usual programmer is on the application
- Parallel and distributed computing programming is an art
- Security is a nightmare
- Multi media programming is all of the above
- Combinations + ad hoc usage ==> towards standards
- Collaboration required by
  - Law (medics in USA)
  - Business (distributed organizations)
  - changing social behavior

## What is happening ?

First mentioned in IETF on an IAB workshop on Internet Information Infrastructure, October 12-14, 1994 (RFC 1862):

Replication and caching schemes could form a sort of network "middleware" to fulfill a common need of distributed services.

In december 1998 a workshop was organized specifically on the topic Middleware. In RFC 2768 a report can be found:

“Network Policy and Services: A Report of a Workshop on  
Middleware”

A follow up was organized by Terena in the spring of 2000 in Leiden:

<<http://www.terena.nl/middleware/>>

## RFC 2768 identified R&D

- **inter-domain resource management architecture and protocols (BB's)**
- **resource languages**
  - describe resources (e.g., networks, data bases, storage, online facilities, etc.)
- **enhanced locators that can locate resources and resource managers**
- **cross administrative policy negotiation and authentication**
- **domain and inter-domain accounting and billing**
- **monitoring and verification services of contracted services**
- **information to middleware services and applications (not just MIBs and SNMP access)**
- **deadlock avoidance, ensuring efficiency with resource managers**
- **network management tools and APIs that provide macroscopic and microscopic real-time infrastructure**
- **middleware bypass (i.e. access to raw system or network resources metadata)**
- **middleware support for mobile or nomadic use**
- **support for availability of resources (i.e. replication and load balancing)**

# • MANAGEMENT

- inter-domain resource management architecture and protocols (BB's)
- resource languages
  - » describe resources (e.g., networks, data bases, storage, online facilities, etc.)
- enhanced locators that can locate resources and resource managers

# • AAA / POLICY

- cross administrative policy negotiation and authentication
- domain and inter-domain accounting and billing
- monitoring and verification services of contracted services

# • DIRECTORIES

- information to middleware services and applications (not just MIBs and SNMP access)
- deadlock avoidance, ensuring efficiency with resource managers
- network management tools and APIs that provide macroscopic and microscopic real-time infrastructure

# • IMPLEMENTATION-API's

- middleware bypass (i.e. access to raw system or network resources metadata)
- middleware support for mobile or nomadic use
- support for availability of resources (i.e. replication and load balancing)

**Intentionally omitted in RFC 2768**

- **That workshop did not:**
  - Define the term Middleware
  - Propose an architecture
  - Specify what belongs to Middleware
  - And, more important, what not


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## Middleware

Middleware 101  
[\(PDF\)](#) [\(PPT\)](#)

Current Activities in Middleware  
[\(PDF\)](#) [\(PPT\)](#)

PKI: News from the Front and  
 Views from the Back  
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Middleware, or "glue", is a layer of software between the network and the applications. This software provides services such as identification, authentication, authorization, directories, and security. In today's Internet, applications usually have to provide these services themselves, which leads to competing and incompatible standards. By promoting standardization and interoperability, middleware will make advanced network applications much easier to use. The **Internet2 Middleware Initiative (I2-MI)** is working toward the deployment of core middleware services at Internet2 universities.

### [MACE](#)

[Shibboleth](#)  
 Web access control project

### [VidMid](#)

[Early Harvest](#)  
[Draft Best Practices](#)  
 for identifiers, authentication, and directories

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[Outline](#)

[Internet2 and the Space Physics and  
 Aeronomy Research Collaboratory](#)

[NSF Network Centric MIDDLEWARE  
 Services \(MWIR\)](#)  
 program announcement, white paper  
*Proposal deadline:*  
 May 10, 2001

### [Core Middleware and Associated Activities](#)

- [Identifiers](#)
  - [Identifier Mappings](#)
  - [Draft Guide to OIDs](#)  
(DOC)
- [Authentication](#)
- [Directories](#)
  - [DoDHE](#)
  - [eduPerson](#)
  - [LDAP Recipe](#)
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### [Upper Middleware](#)

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- [I2-DSI](#)
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- [Net@EDU PKI Working Group](#)

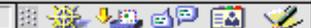
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## Internet2 definition

from: <http://middleware.internet2.edu/>

- Middleware, or "glue", is a layer of software between the network and the applications. This software provides services such as identification, authentication, authorization, directories, and security.
- In today's Internet, applications usually have to provide these services themselves, which leads to competing and incompatible standards. By promoting standardization and interoperability, middleware will make advanced network applications much easier to use. The Internet2 Middleware Initiative(I2-MI) is working toward the deployment of core middleware services at Internet2 universities.
- **In my view this is only a part of middleware**

## Internet2 activities

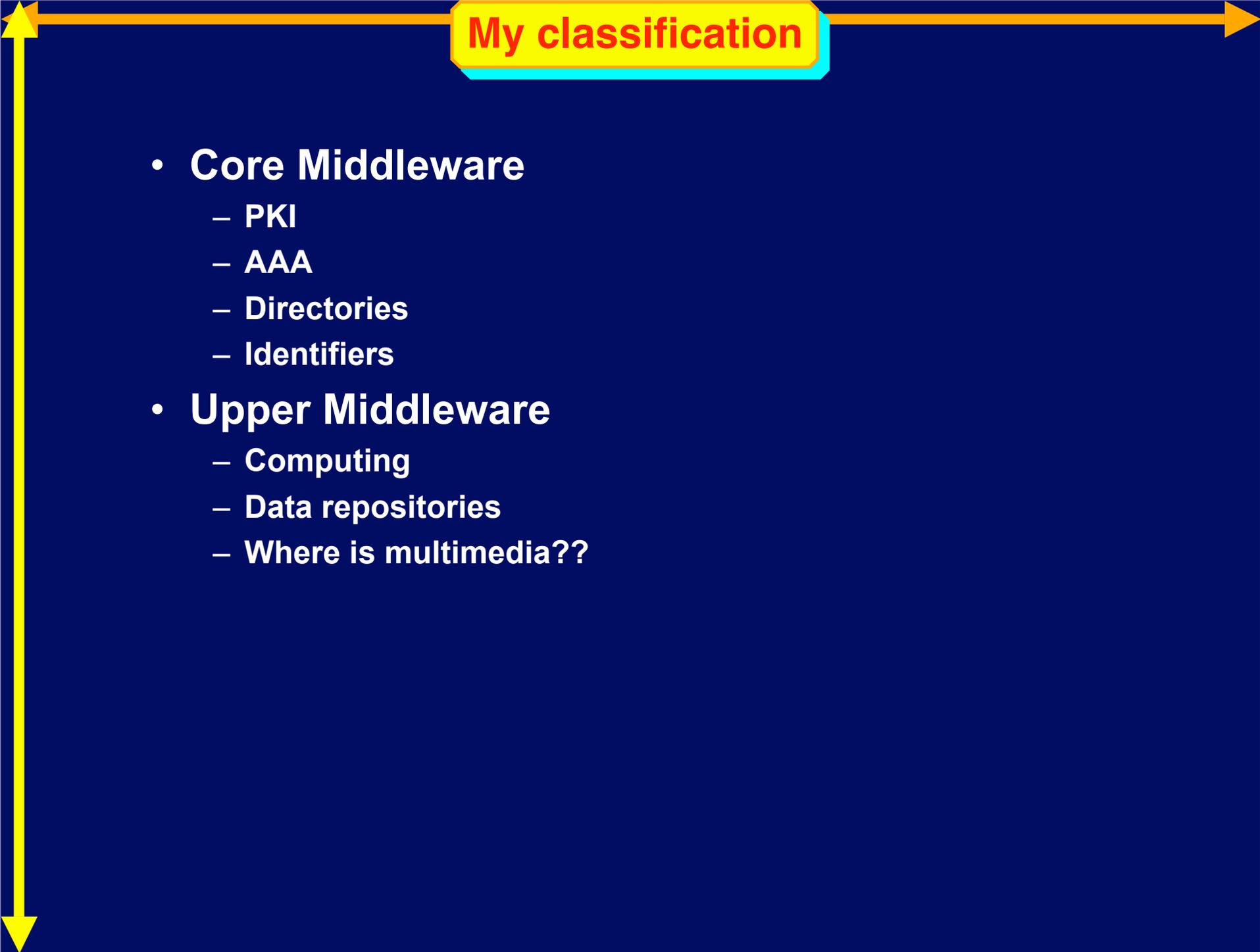
- **MACE (Middleware Architecture Committee for Education)**
- **Shibboleth**
  - Web access control project
- **VidMid**
  - the video working group of the Internet2 Middleware Initiative, exists to further the development of middleware for digital video and related areas. The group's initial focus will be on resource discovery and authentication for point-to-point and multi-point videoconferencing.
- **Early Harvest**
  - Draft Best Practices for identifiers, authentication, and directories
  - Early Adopters
- **Multicampus Systems Discussion Outline**
- **Internet2 and the Space Physics and Aeronomy Research Collaboratory**
- **NSF Network Centric MIDDLEWARE Services (MWIR)**

- **Core Middleware and Associated Activities**
  - **Identifiers**
    - » Identifier Mappings
    - » Draft Guide to OLD's (Object Identifiers)
  - **Authentication**
  - **Directories**
    - » DoDHE
    - » eduPerson
    - » LDAP Recipe
  - **Authorization**
  - **Certificates and PKI**
    - » HEPKI
    - » Internet2 PKI Labs

- **Upper Middleware**

- **Related Projects and Organizations**

- » **CNI (Coalition for Networked Information )**
    - » **CREN (Corporation for Research and Educational Networking )**
    - » **CSG (Common Solutions Group)**
    - » **Federal PKI Technical Working Group**
    - » **Net@EDU PKI Working Group**
    - » **Globus**
    - » **Grid Forum**
    - » **Legion**
    - » **I2-DSI (Distributed Storage Infrastructure)**



## My classification

- **Core Middleware**
  - PKI
  - AAA
  - Directories
  - Identifiers
- **Upper Middleware**
  - Computing
  - Data repositories
  - Where is multimedia??

# What does industry sell as middleware

SGI

Netscape: SGI - SGI 2000 Series: Server Solutions: Availability

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Netsite: [http://www.sgi.com/origin/2000/server\\_sol/available.html#middleware](http://www.sgi.com/origin/2000/server_sol/available.html#middleware)

SuperStack II R /hdmob/Bureau... nos-TT 100 - NO VersionTracker MacNN: The Maci MacFixIt.com: T Accelerate Your MacInTouch Home

smbd--NT/Windows 1.917P4 Samba

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MEDIA SERVING		
Application	Version	Developer
Cineon	3.5	Kodak
Video Server	3.0 beta	Oracle
Spirit Datacine		Philips
StreamCaster	2.0	SGI
WebFORC@ MediaBase	2.0	SGI

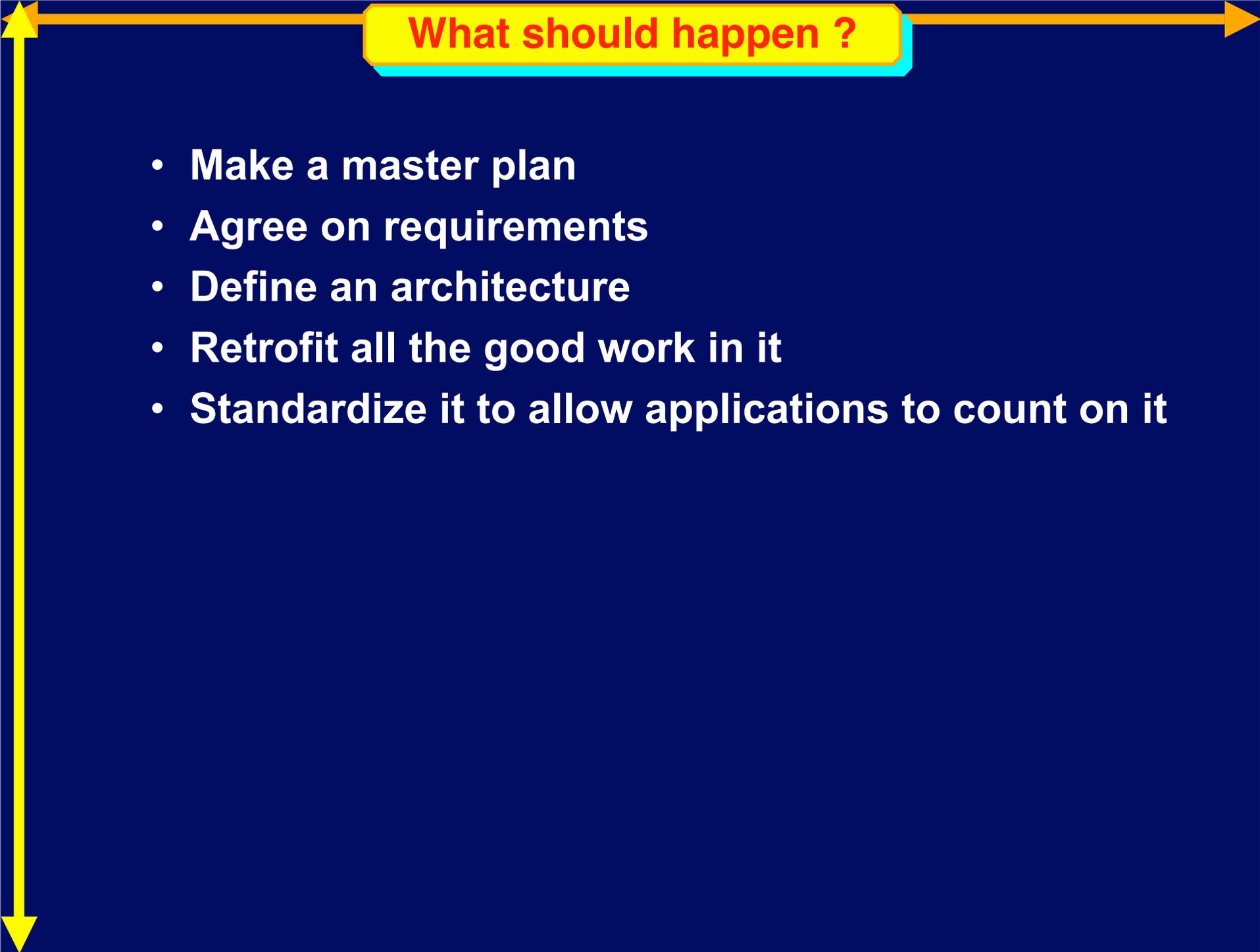
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MIDDLEWARE		
Application	Version	Developer
Web Pipeline	B.11	Collage
SphinxVision	1.0	ASOC
Brio		BrioQuery
Cognos	5.2	DowerPlay
Data Insight	1.x	Data Insight
DB	5.00	Objectivity
C++	5.00	Objectivity
C++ Component Suite	2.05	Object Space Technologies

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## What does industry sell as middleware

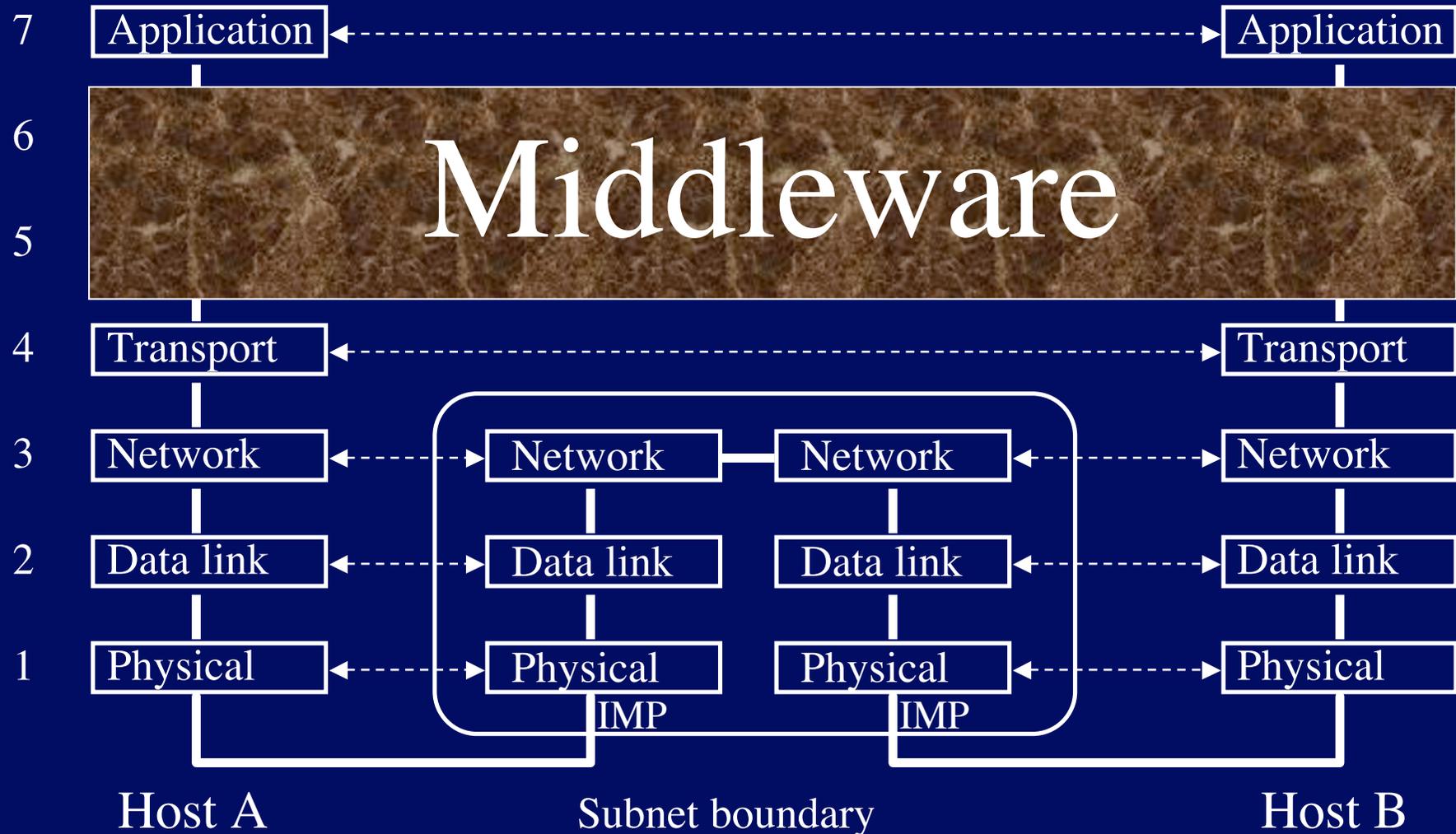
- **object brokers**
- **Data bases**
- **Programming environments**
- **Application Server Provider Environments?**



## What should happen ?

- **Make a master plan**
- **Agree on requirements**
- **Define an architecture**
- **Retrofit all the good work in it**
- **Standardize it to allow applications to count on it**

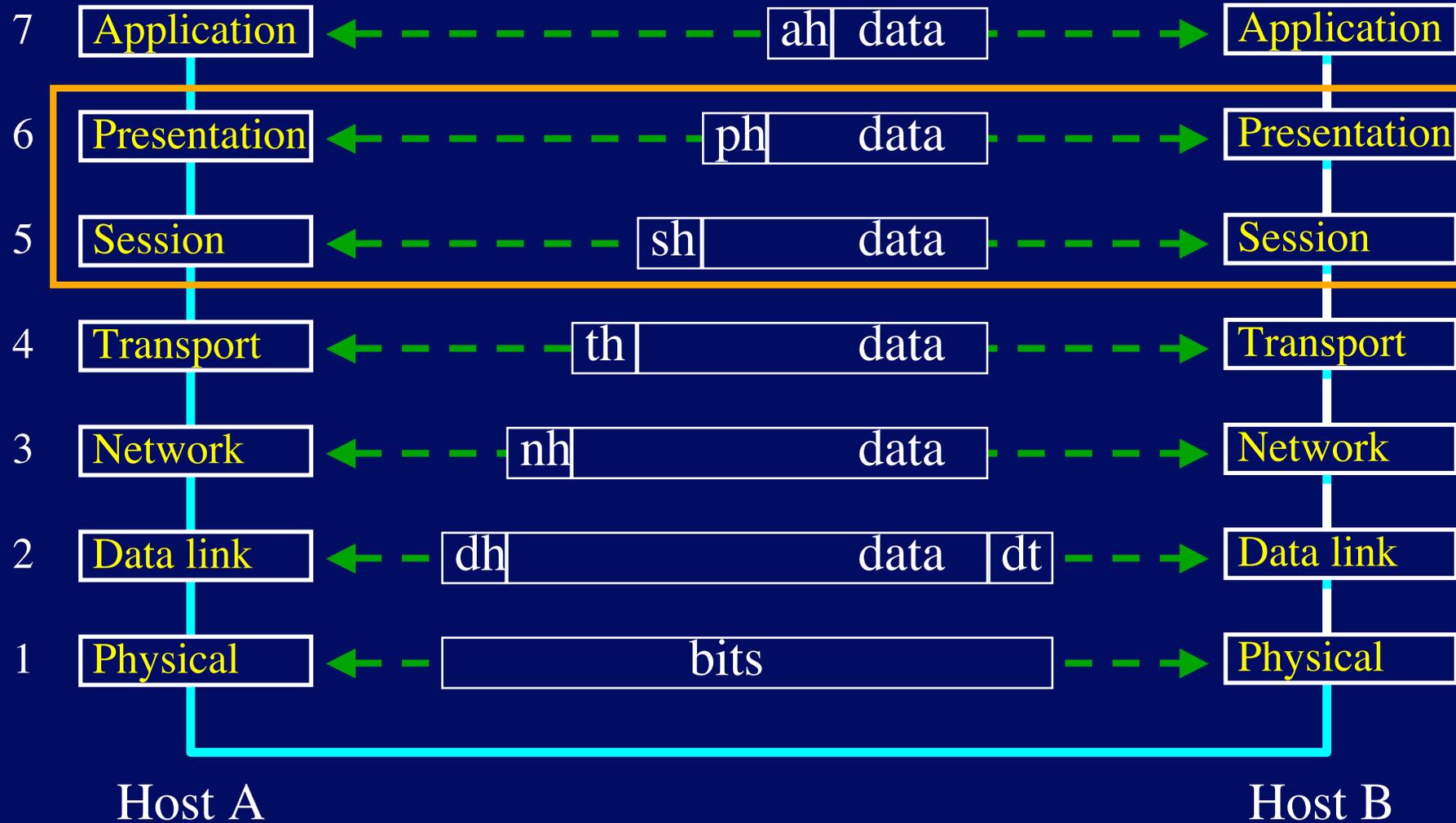
# The OSI Reference Model



— = data path

IMP = interface message processor

# The OSI Reference Model



— = data path

← → = protocol path

# Modeling Middleware

**Application**

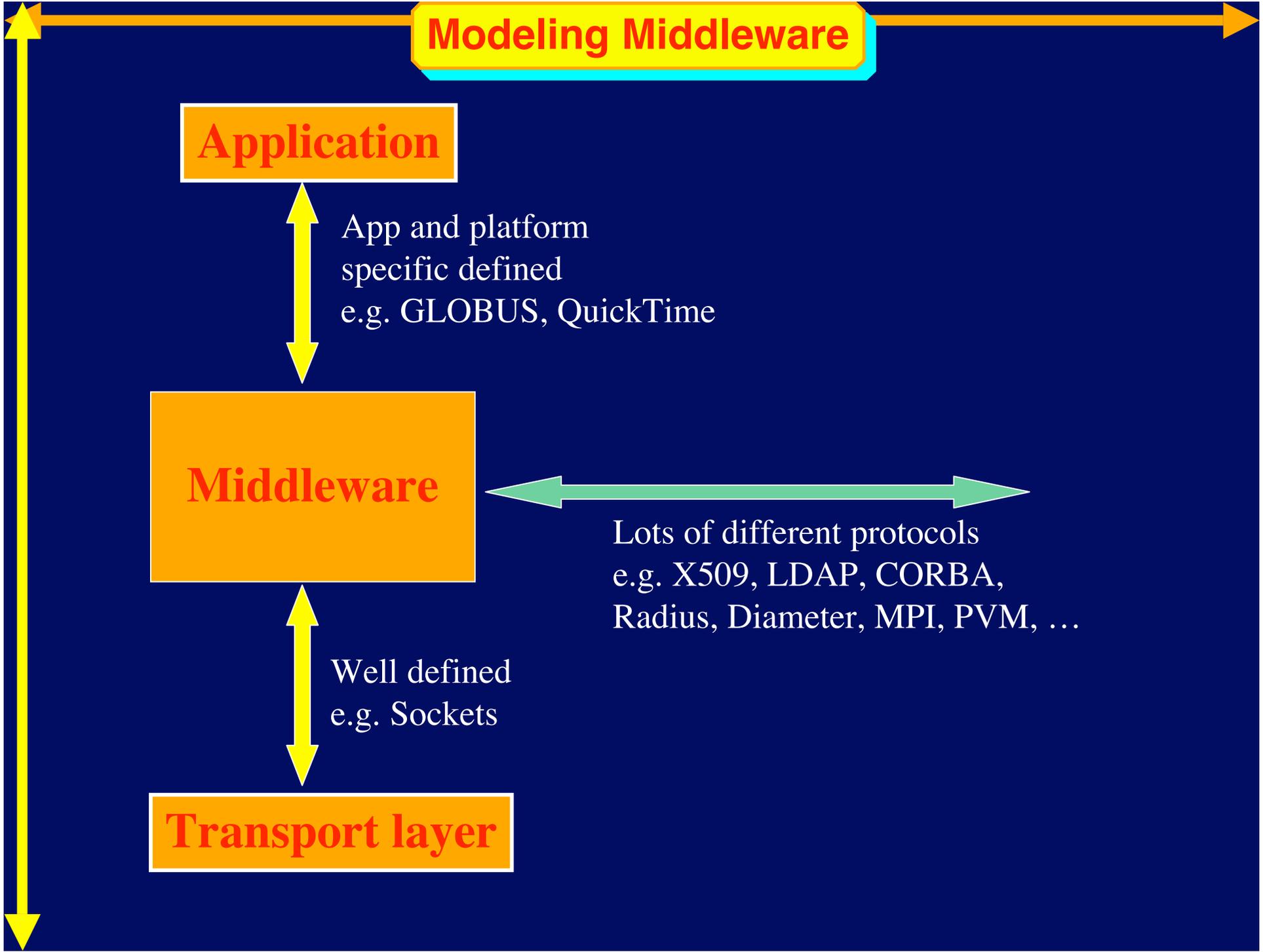
App and platform  
specific defined  
e.g. GLOBUS, QuickTime

**Middleware**

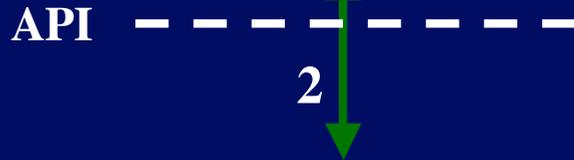
Lots of different protocols  
e.g. X509, LDAP, CORBA,  
Radius, Diameter, MPI, PVM, ...

Well defined  
e.g. Sockets

**Transport layer**

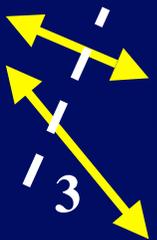


Starting point

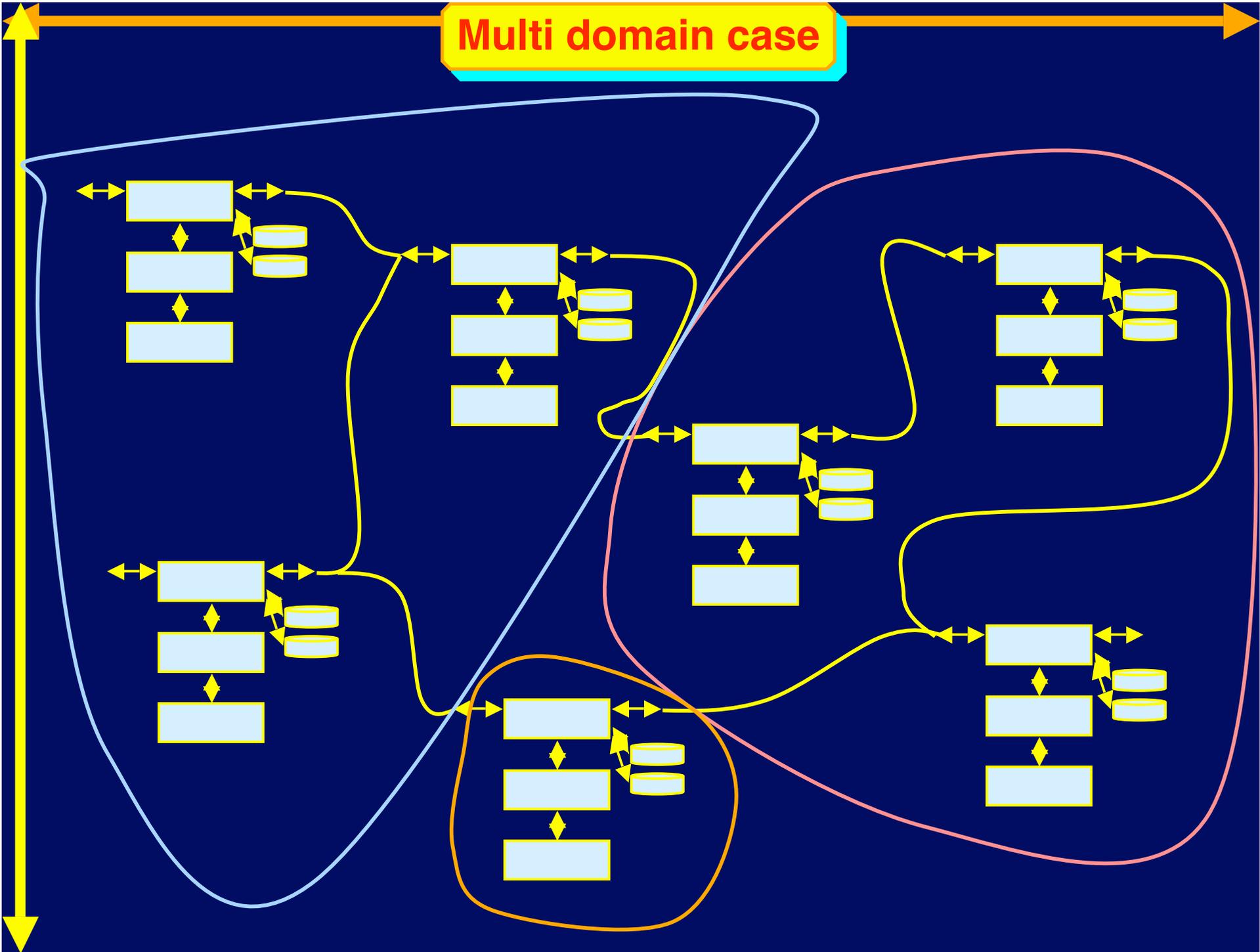


PDP

PEP



# Multi domain case



## My view of ideal middleware

- **Middleware as an abstraction layer for the usage of services and resources on the Internet**
- **Middleware should allow to be adapted, enlarged, refined, without making it necessary to adapt or reprogram the application, but the adaptations should immediately be usable in the application**
- **e.g. Opendoc (RIP) by Apple and IBM**

## Is Middleware solving the problem ?

- **Current Middleware projects are certainly solving PARTS of the problems !**
- **Is there a manual on how to produce a standard Middleware component ?**
- **Can we identify more open topics ?**
- **What standardization body to use for what part ?**
- **.....**