



Cloud Computing for the Enterprise

Building Applications for the Cloud

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Agenda

- Enterprise software architecture evolution
- Architecture of an application on IaS
- Architecture of an application on PaaS
- Cloud application development guidelines
- Storage options
- Database options
- Support services
- Influence on architecture due to hybrid deployment
- Why Service Oriented Architecture (SOA) is a must for enterprise computing?

Enterprise software architecture evolution



Jacquard loom - 1801

Enterprise software architecture evolution



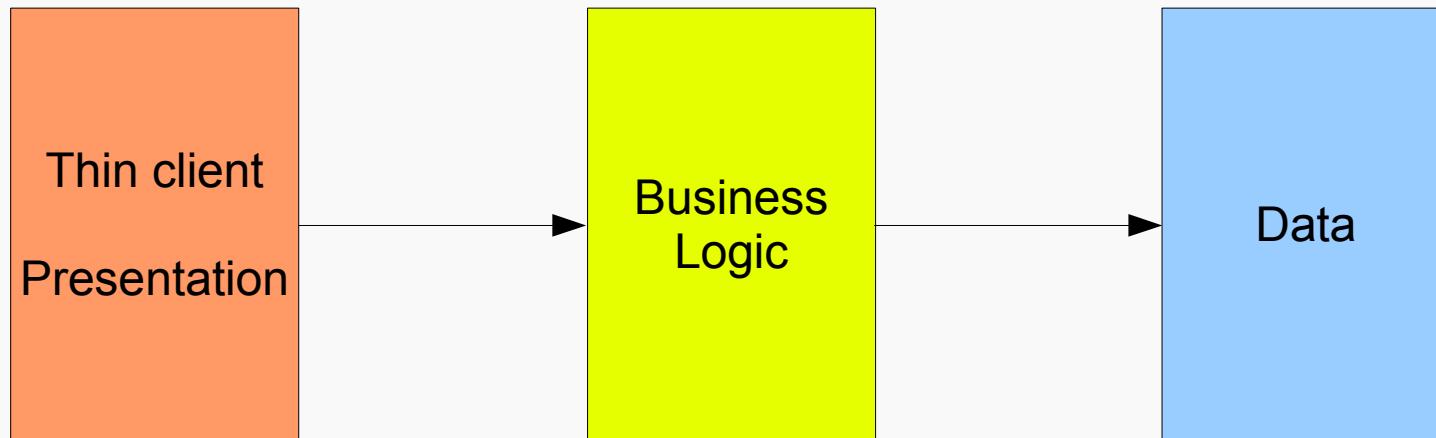
Standalone application

Enterprise software architecture evolution



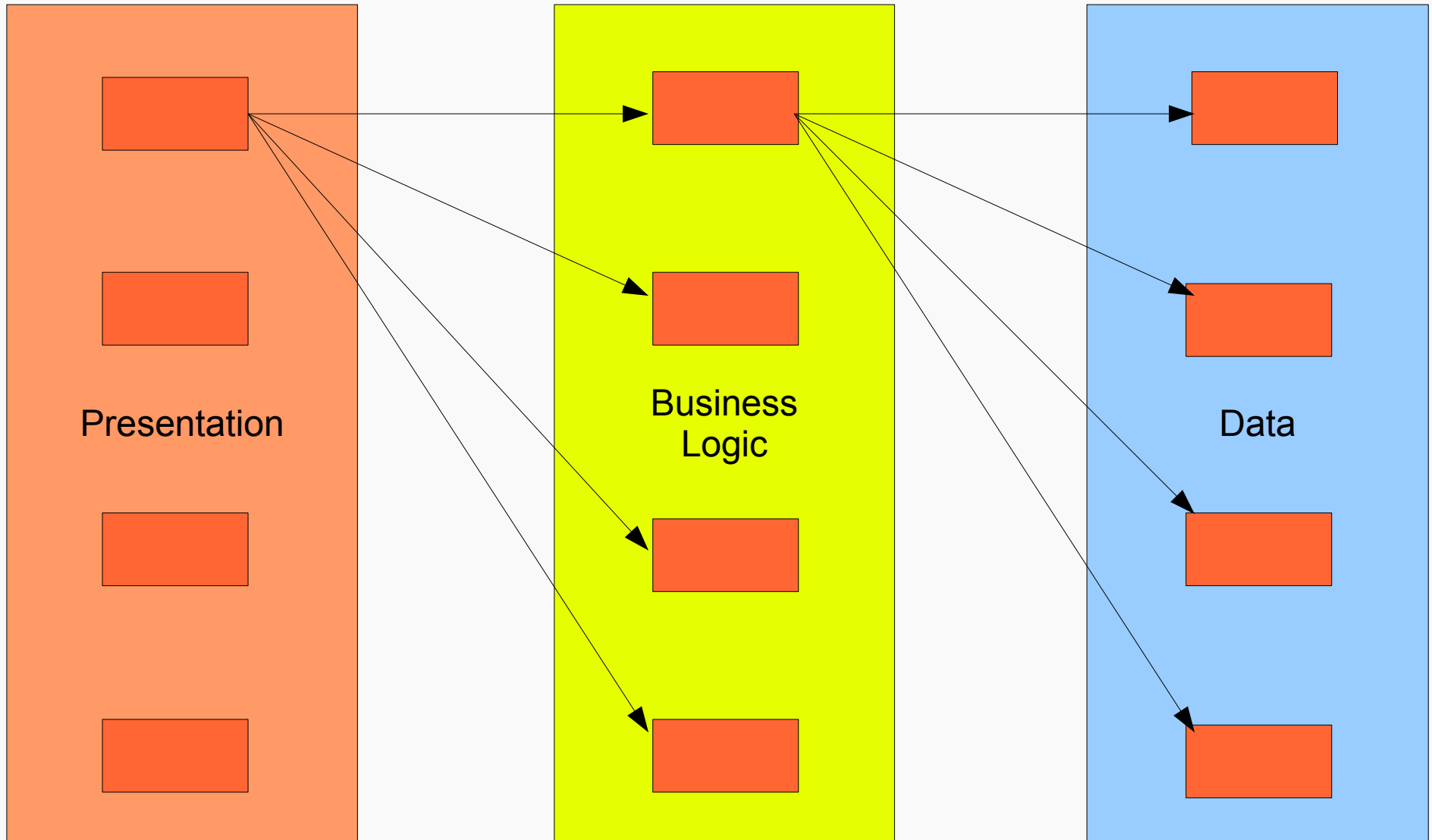
Client – server (2 tier)

Enterprise software architecture evolution



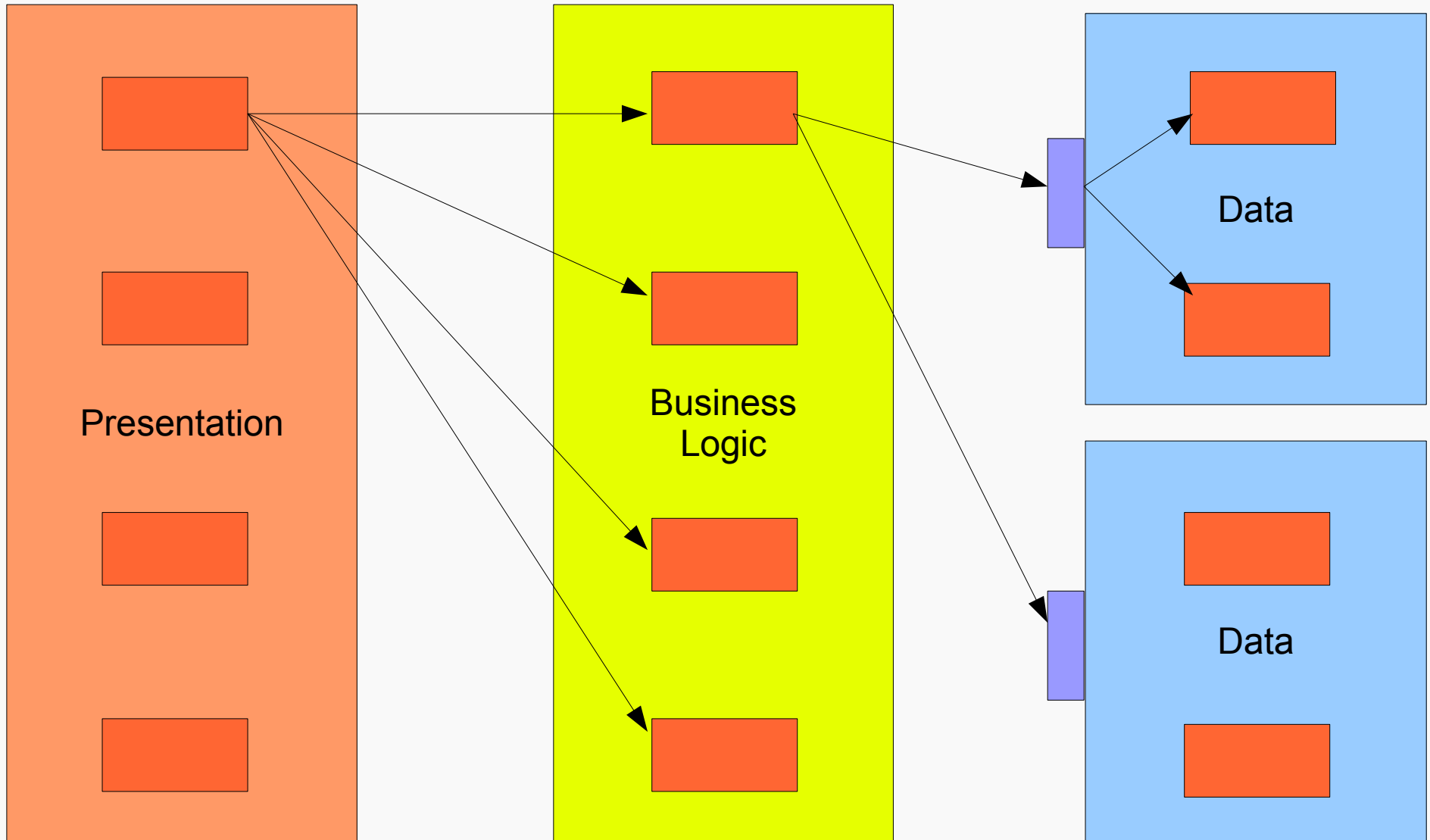
3 tier

Enterprise software architecture evolution



Clustered

Enterprise software architecture evolution

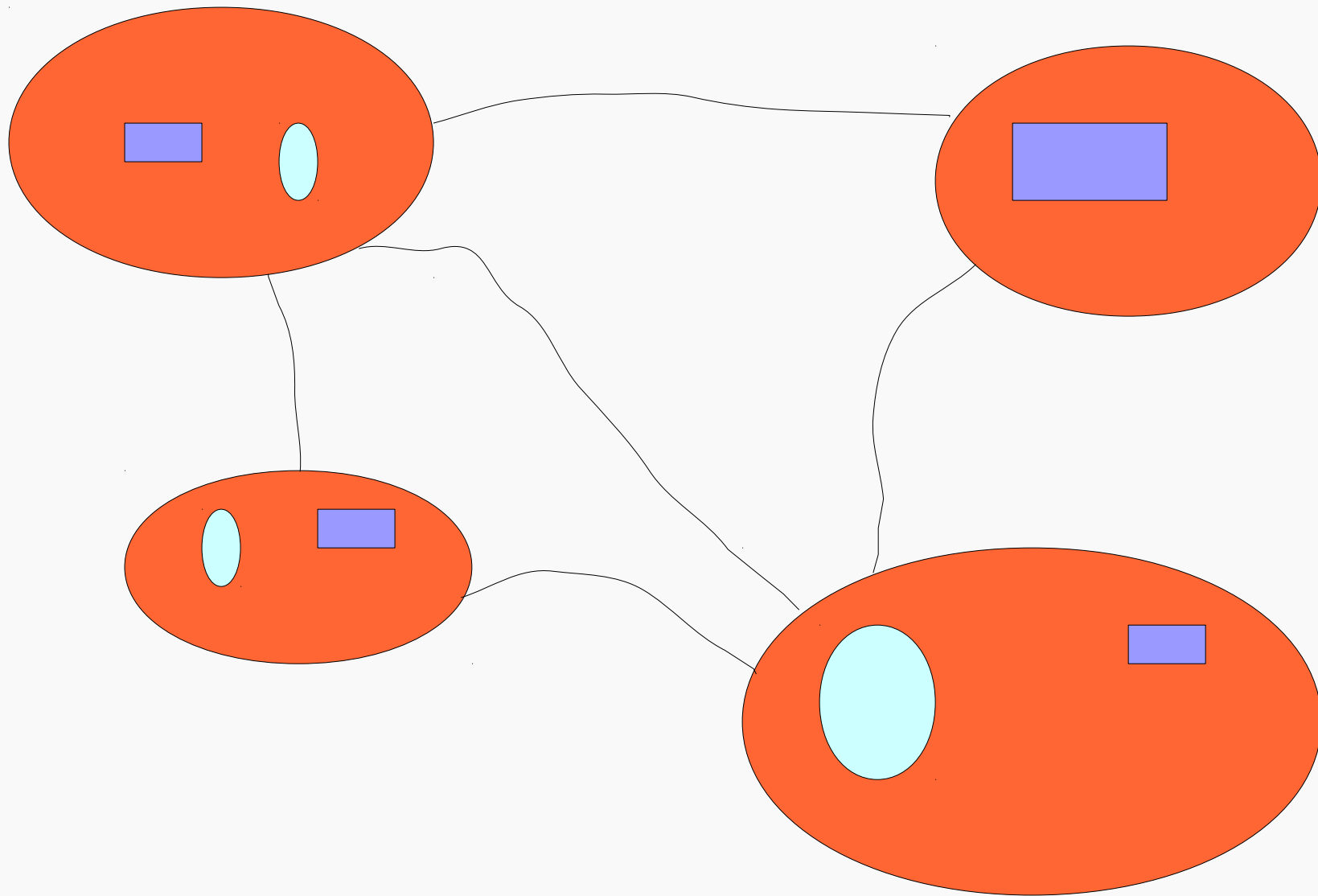


Clustered + partitioned (data)

Enterprise software architecture evolution

- What can be partitioned?
 - Data
 - Business logic
 - Presentation
- Beyond clustering and partitioning
 - We need to share resources
 - We need to select (from shared pool)
 - Then aggregate resources

Enterprise software architecture evolution



Grid computing – distributed supercomputing

Enterprise software architecture evolution

- Grid computing
 - We need to share resources
 - We need to select (from shared pool)
 - Then aggregate resources
- We need
 - A grid master (public interface for job accepting,...)
 - Administration interface
 - A code repository
 - Partition manager (data loading, directing requests to nodes)
 - Messaging cluster
 - Grid nodes!

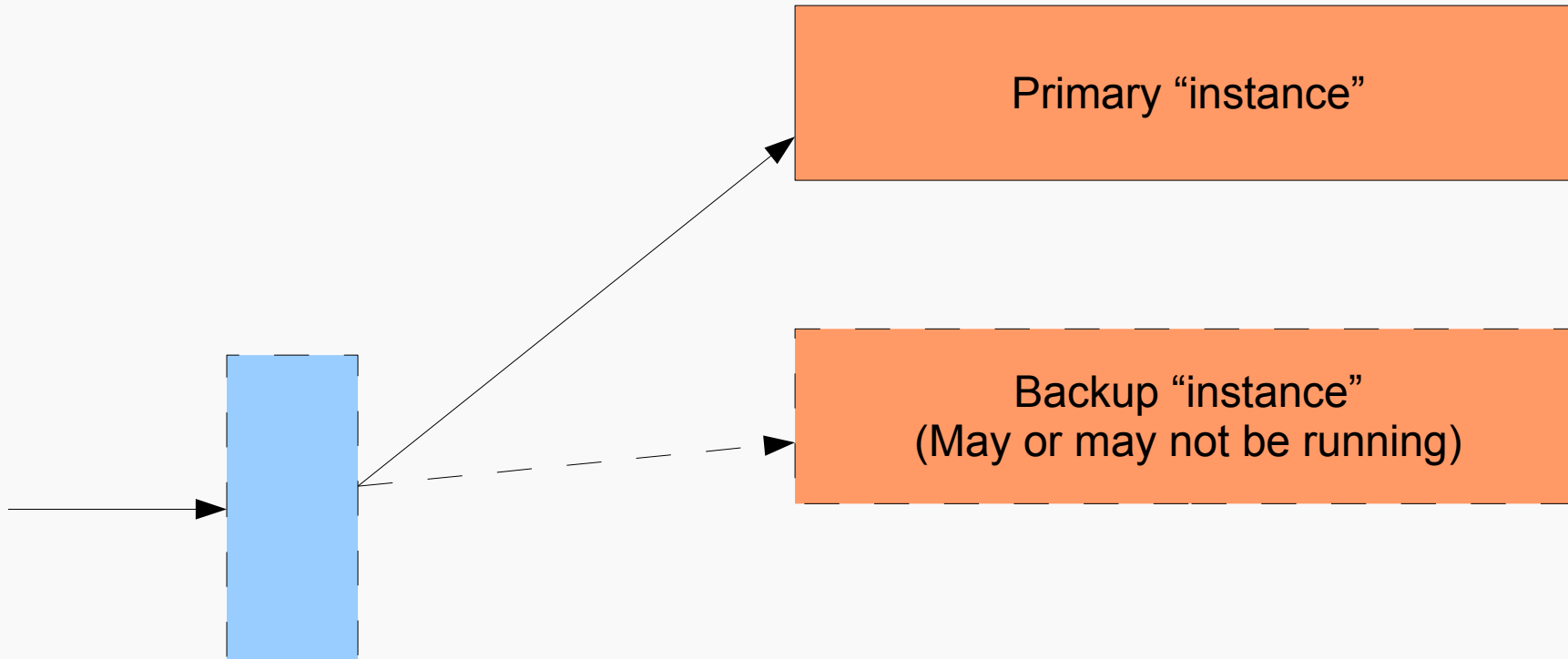
Enterprise software architecture evolution

- How to cook the cloud soup?
 - Get a pint of grid computing
 - Add several more pints of virtualization (cpu, memory, storage, network – don't worry about from where they come)
 - Let the virtualization settle in whatever the way
 - Add utility computing as needed
 - This is sufficient to serve the world now

Technical view of the cloud

- A network of computer arranged in an **unknown topology**
- You **don't have to know about this unknown topology**
- You **need to know how to talk** to machines though
- The whole arrangement should be able to **reconfigure itself**
 - For example, network latency will be handled by the cloud

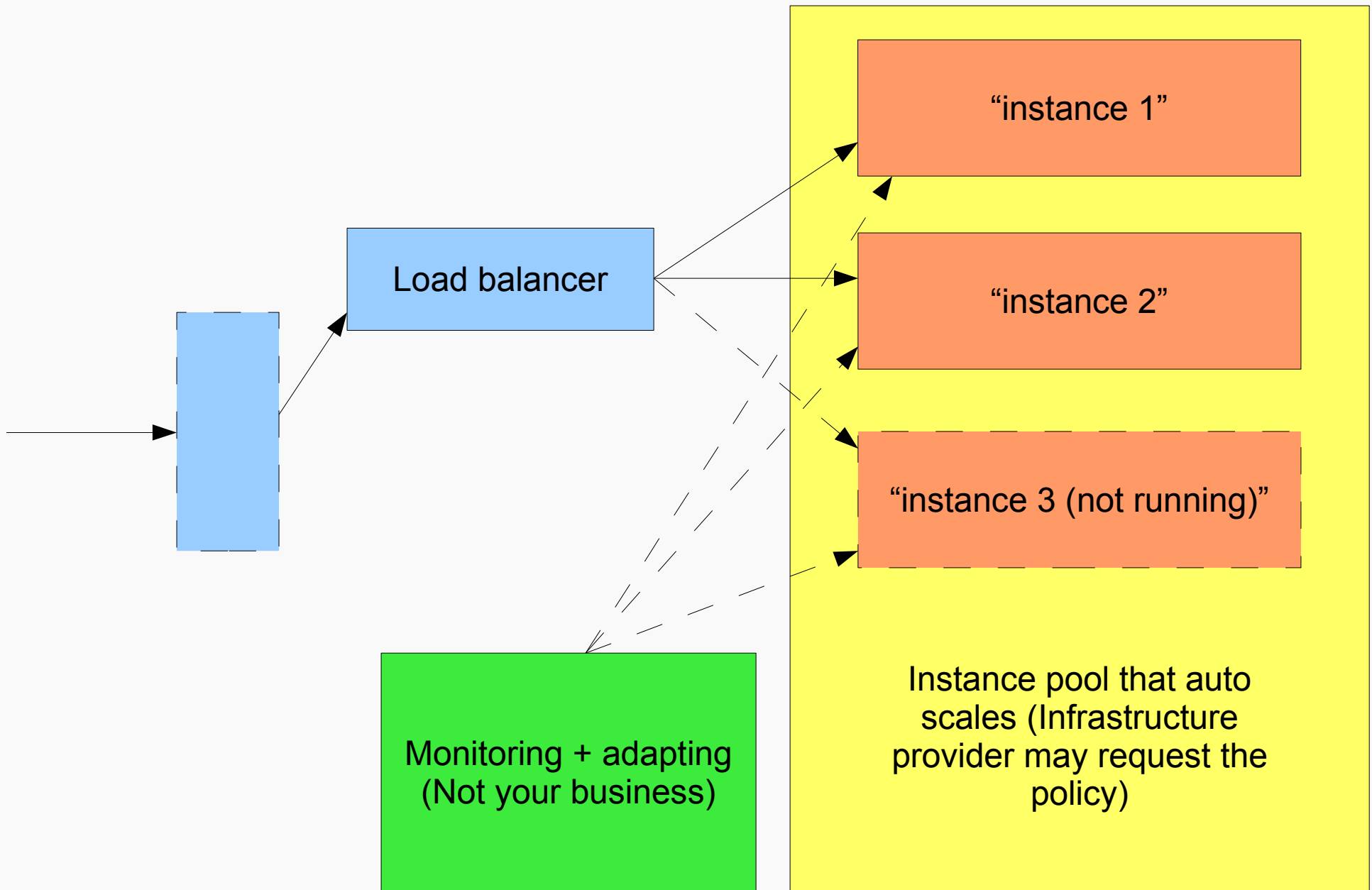
Architecture of an IaS application



Virtualized IP – not load balancing

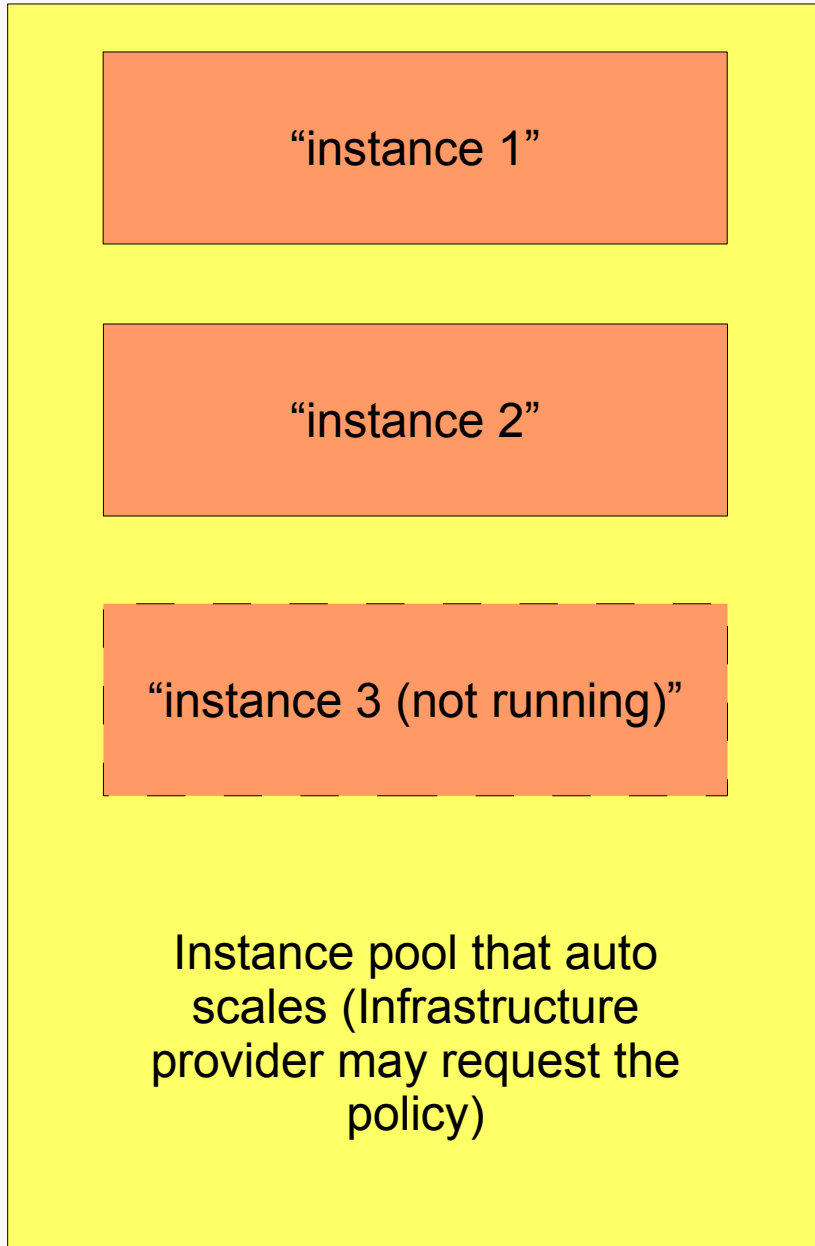
- Provides fail over without an IP change
- You may need to monitor and request the switching from the network management service

Architecture of an IaS application

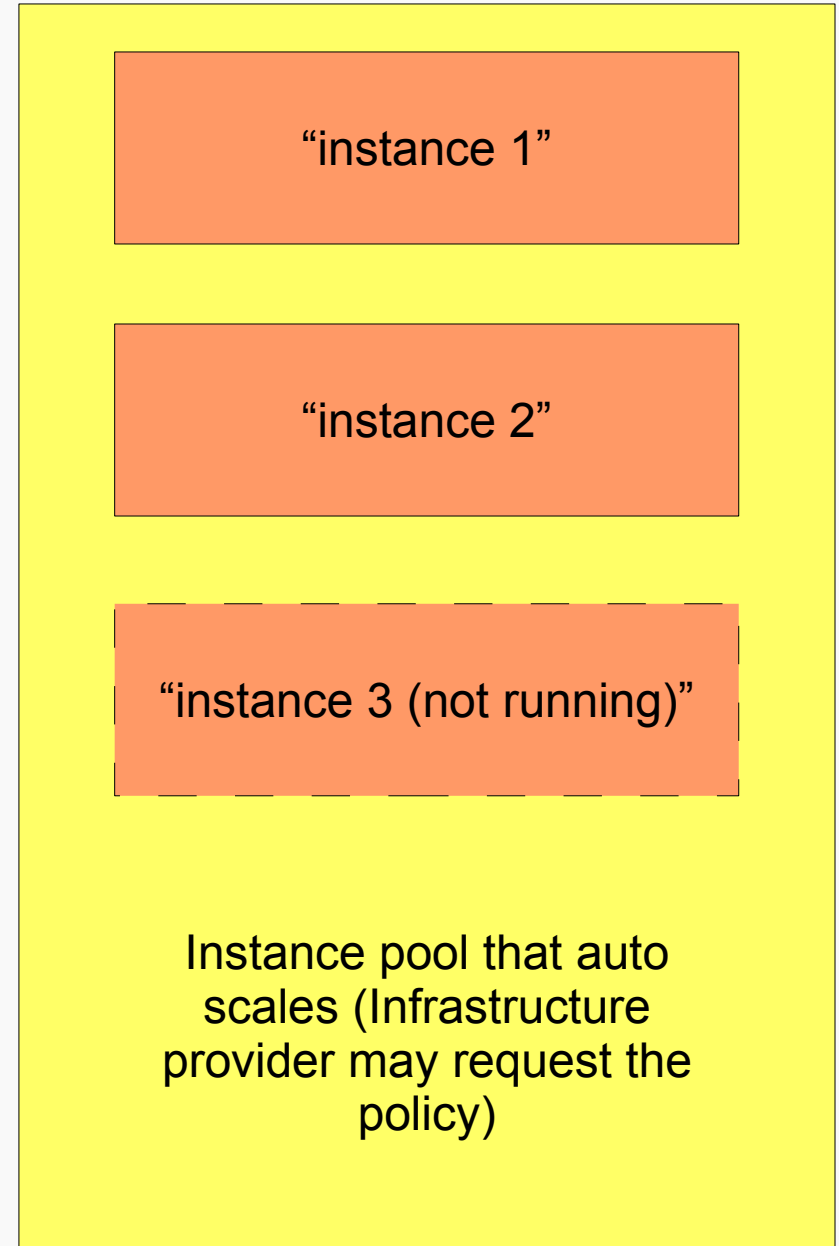


Architecture of an IaS application

Aspect 1 (Web servers)



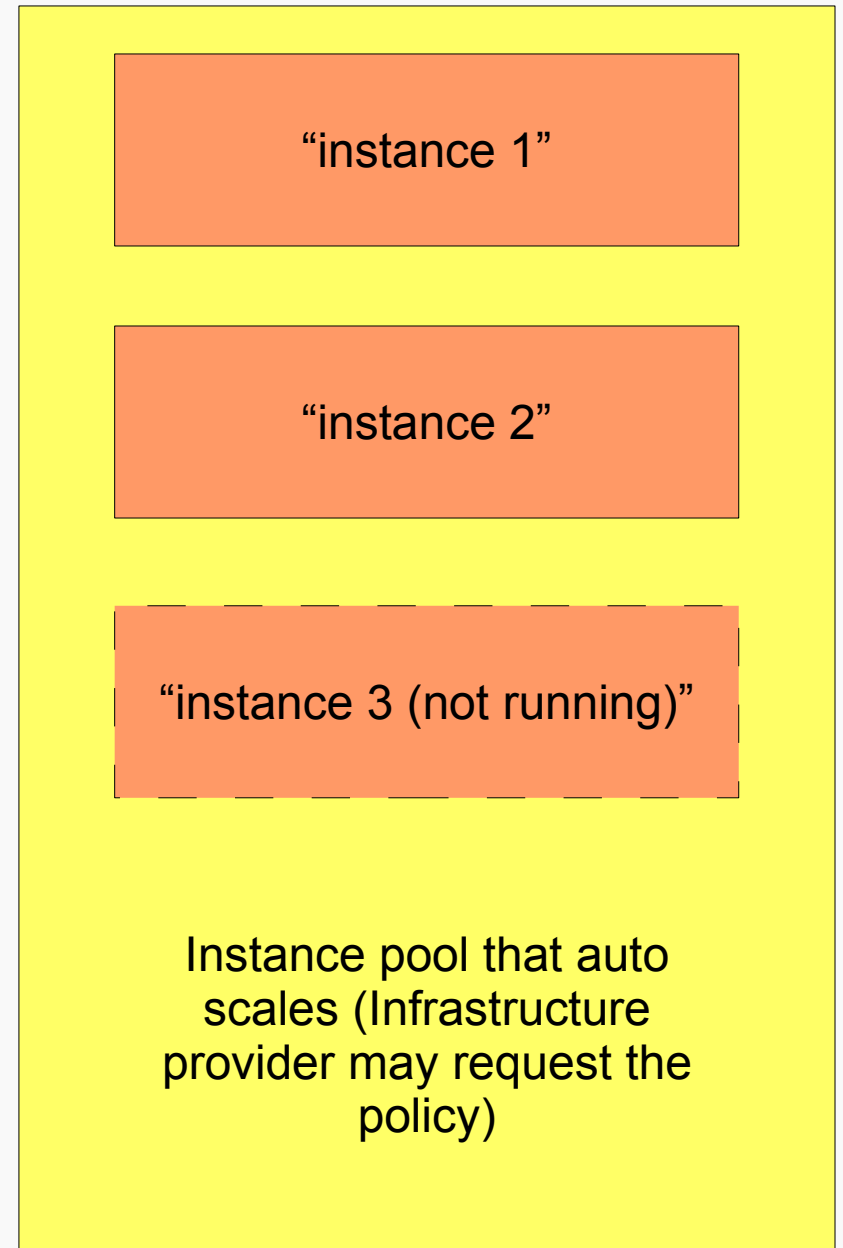
Aspect 2 (Business logic)



Architecture of an IaS application

- External storage will allow arbitrary size storage
- External database will allow arbitrary size data
- You may have select the exact external storage option and database option
- Where's the application?

Aspect 2 (Business logic)



Architecture of an IaS application

- IaS provides a auto scaling infrastructure
- Your application needs to do everything else
 - Use other virtualized service APIs (e.g. Access to email, storage, database, ...)
 - Authentication/authorization and other security tasks
 - Internal load balancing (as the infrastructure scales up/down)

Architecture of a PaaS application

- You don't know in which machine your application is running.
- You rent a virtual application server (not managed by you)
- Use the service provider's APIs to access services. Beyond what's in the APIs, you cannot do much.
- Restricted form of the application
 - Can SSL be used? May be not in the way you want.
 - Can you backup? May be not in the way you want.

Cloud application development guidelines

- Determine the model
 - Can you simply use the PaaS model? It's easier. But less flexible.
 - Do you want to use the IaaS model? It's not easy, but flexible.
- Look at the other services offered by the provider
 - Complementary services may already be available

Storage options

- Amazon Web Services (AWS)
 - Local instance storage of EC2 instances
 - Typical file system
 - Amazon Simple Storage Service (S3)
 - External 'object' store that can be accessed from any Internet connected system.
 - Amazon Elastic Block Store (EBS)
 - External file system
- Google App Engine
 - Blobstore
 - Store very large objects that cannot easily be handled via database calls

Database options

- Amazon Web Services (AWS)
 - Amazon SimpleDB
 - A non-relational data store optimized by Amazon
 - Amazon Relational Database Service
 - MySQL or Oracle DB instances with simplified manageability options (auto backup, durability, snapshot recovery, scale up/down via API calls).
 - Amazon ElastiCache
 - In-memory cache
- Google App Engine
 - JDO
 - JPA
 - No SQL

Support services

- Amazon Web Services (Categories only)
 - Content delivery
 - Deployment and management
 - E-commerce
 - Messaging
 - Monitoring
 - Networking

Support services

- Google
 - Data pushing to browser service (than polling)
 - Image manipulation
 - Mail
 - Multitenency
 - Background task execution
 - Oauth – Lets your application users to use Google services like spreadsheet
 - Users – Lets users login to your app via Google login page

Influence due to hybrid deployments

- Application needs to support what's available in both ends. Clear boundaries are demanded
- Can the cloud end load the non-cloud end than it can handle? Throttling, job queuing needs go up.
- Distributed authentication/authorization requirement
- Increased need to use middleware

Why SOA is a must (for enterprise computing)?

- It is surely possible to build applications without SOA.
- From a technical perspective, combining flexible middleware enabled by SOA with flexible infrastructure is brining down a lot of hazel.
 - e.g. AWS, Google already uses web services and related middleware models a lot
- From a business perspective, service orientation of an organization demands 'scalable' infrastructure. Cloud computing is an ideal supply source. Win-win!



Thank you