Cloud Encounters

Measuring the Computing Cloud

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Session #616

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Clouds

- Do they exist?
- Do they scale?

Clouds are Real

- We made actual measurements of a number of computing clouds, including their progression over time.
- This is stuff you need to know when you select a cloud infrastructure.

Note:

- Author is not employed by any of the companies mentioned.
- No animals were harmed in the conduct of this research

What clouds?

Cloud Model	Fast deployment of virtual servers
Main cost unit	Virtual server
Examples	Amazon

Amazon Elastic Compute Cloud (Amazon EC2) - *Beta*

What clouds?

Cloud Model	Hosted applications
Main cost unit	User Account / Month
Examples	Google Sites Google Apps Salesforce.com LinkedIn

What clouds?

Cloud Model	(Static) Content Distribution Network
Main cost unit	Delivery of single image, movie
Examples	Akamai Amazon Cloudfront Rackspace Cloudfiles

What clouds?

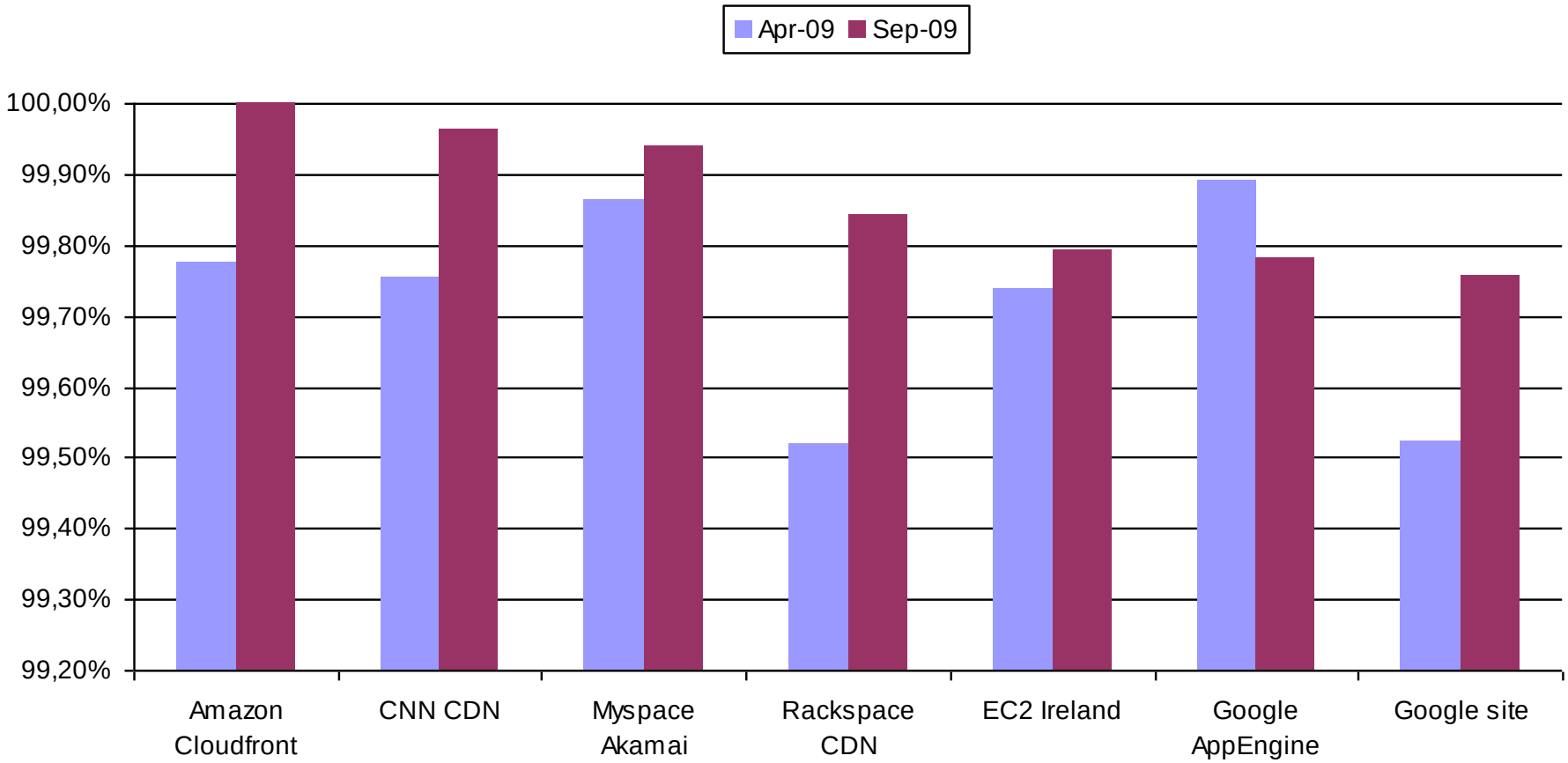
Cloud Model	Distributed, scalable processing
Main cost unit	API call, Chunk of code
Examples	Google App Engine Windows Azure (FaceBook API)

Measurement Methodology

- More than 30 monitoring stations on all continents
- Measurement is typically HTTP Get for a specific URL

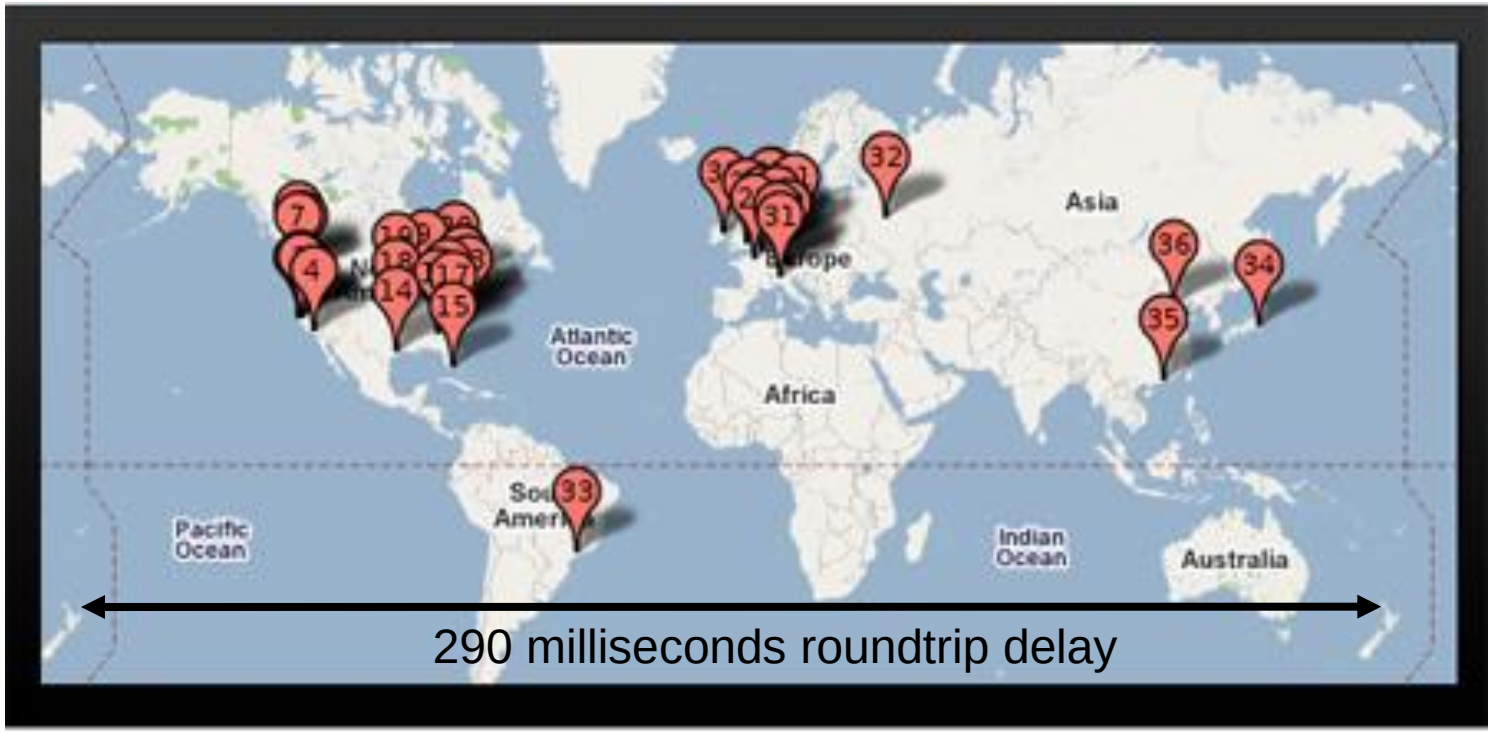
WatchMouse.com

Cloud uptime is pretty good, and getting better



Each bar represents > 7000 test requests
using world-wide monitoring stations by WatchMouse

Where is the cloud?



Google data centers across the world (April ‘08)

http://www.techcrunch.com/2008/04/11/where-are-all-the-google-data-centers/

Proximity Matters

Clouds can be really close

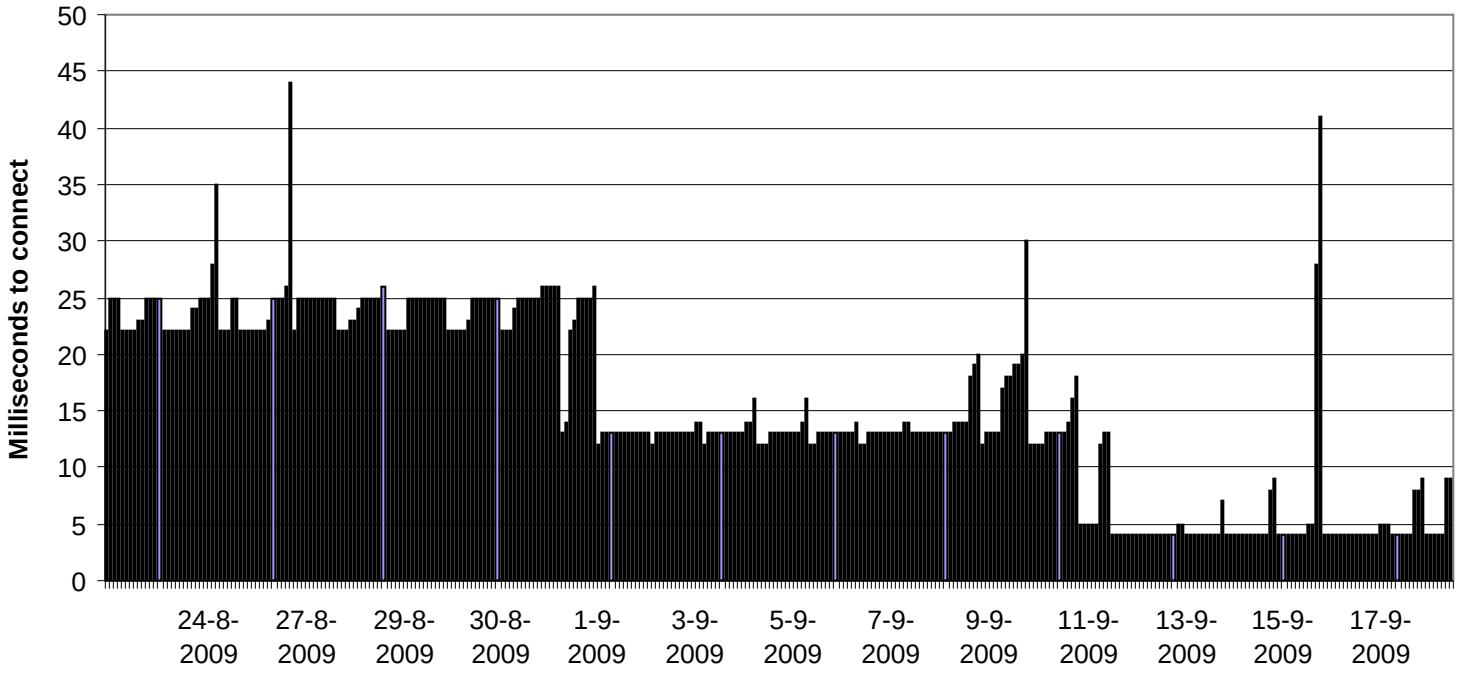
Cloud operator	Apr 09	Sep 09
Myspace Akamai	30	30
Google AppEngine	57	54
Amazon Cloudfront	51	53
Mosso CDN	54	58
Google Site	62	63
CNN CDN	81	56
EC2 Ireland	121	116
Regular NY site	127	127

Akamai is pretty much everywhere

Cloud proximity =

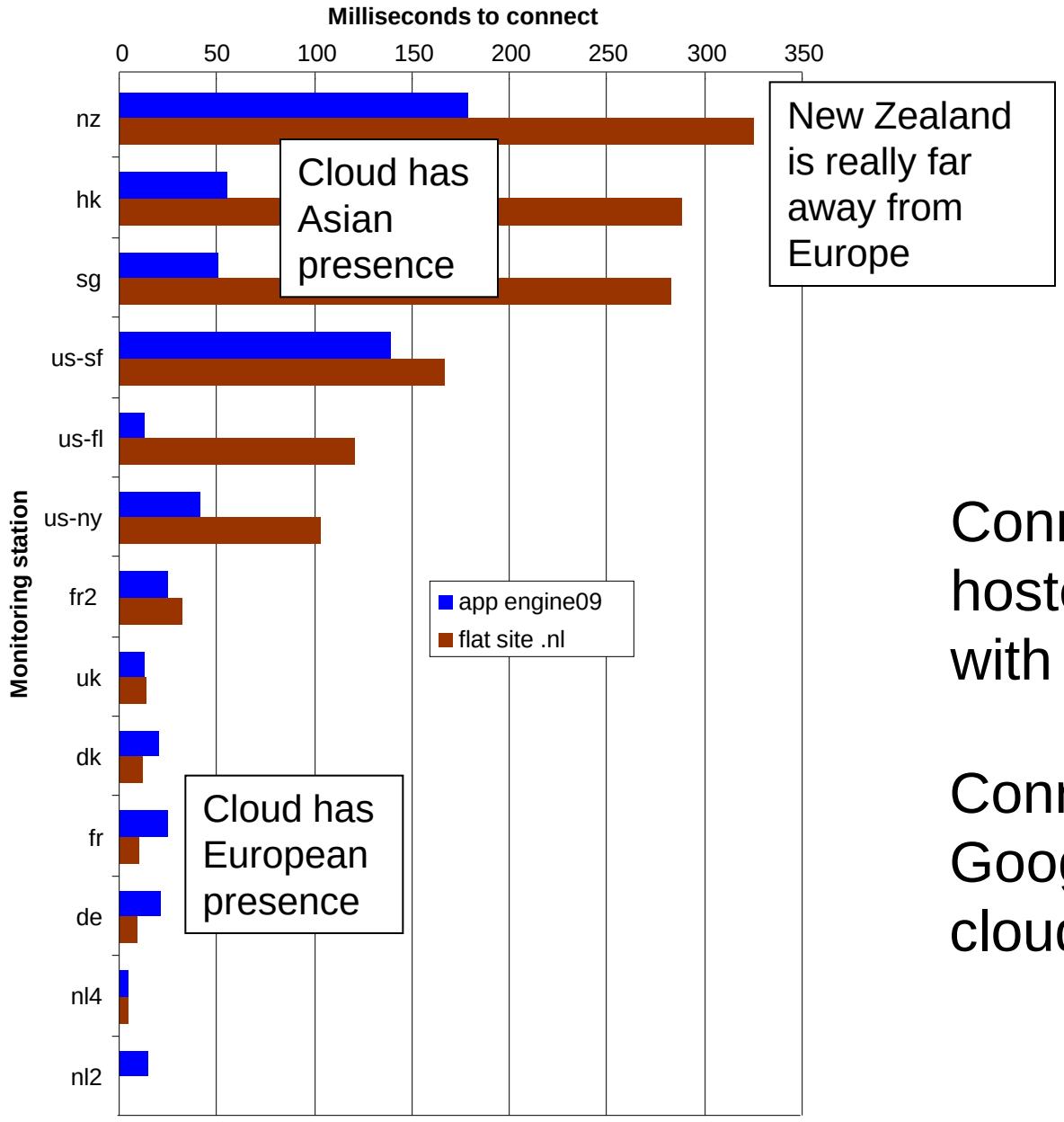
average distance of cloud to 35 monitoring stations (in milliseconds roundtrip)

Connect times from NY to Amazon Cloudfront



Better peering and/or better routing?

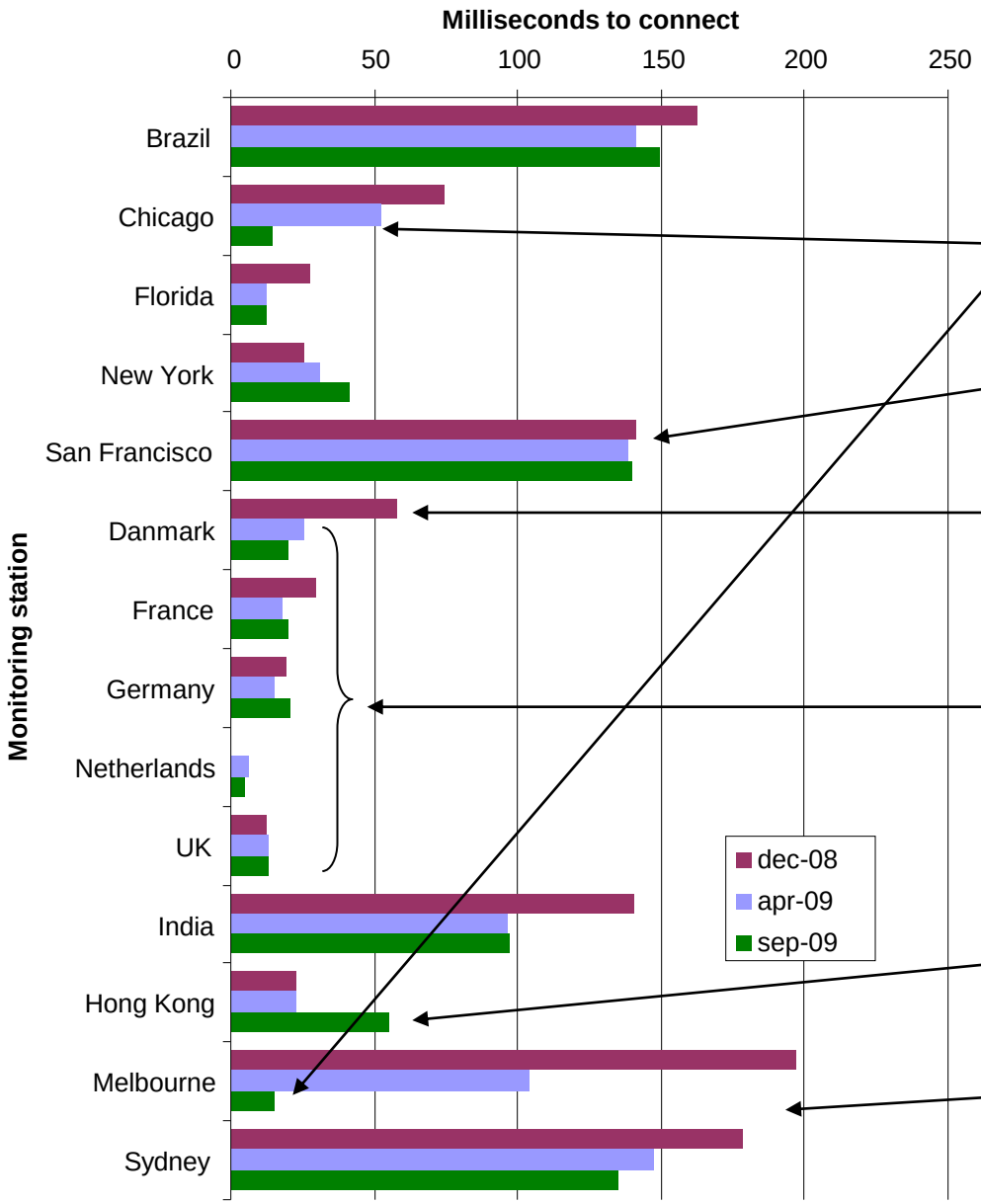
Clouds can be everywhere



Connect time to a single hosted site increases with distance.

Connect time to the Google App Engine cloud does not.

Clouds evolve over time



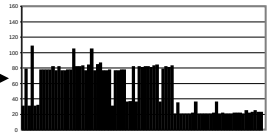
Google's coverage has increased in '09

San Francisco. Puzzling?

Missed real location of Denmark in '08

Europe has good Internet

Hong Kong had a routing issue in Sept



Suboptimal routing in Australia

Routing the Cloud

DNS lookups for **helloworld.appspot.com** are location and time dependent

helloworld.appspot.com. IN CNAME appspot.l.google.com.
appspot.l.google.com. IN A 209.85.129.141
appspot.l.google.com. IN A 209.85.135.141

In addition, the DNS addresses are multicast

Location	IP address
Antwerp, Belgium	209.85.129.141
Odessa, Ukraine	
Oslo, Norway	
Amsterdam2, Netherlands	209.85.135.141
Haifa, Israel	
Krakow, Poland	
Mumbai, India	209.85.153.141
Chicago, U.S.A.	209.85.225.141
Amsterdam, Netherlands	216.239.59.141
Copenhagen, Denmark	
Dublin, Ireland	
Groningen, Netherlands	
Johannesburg, South Africa	
München, Germany	
Stockholm, Sweden	
Zurich, Switzerland	
Melbourne, Australia:	66.102.11.141
Auckland, New Zealand	72.14.203.141
Hong Kong, China	
Nagano, Japan	
San Francisco, U.S.A.	
Shanghai, China	
Singapore, Singapore	
Sydney, Australia	
Amsterdam3, Netherlands	74.125.39.141
Paris, France	
Cologne, Germany	74.125.43.141
Lille, France	
London, United Kingdom	
Moscow, Russia	
Padua, Italy	
Austin, U.S.A.	74.125.45.141
Florida, U.S.A.	74.125.47.141
Santa Clara, U.S.A.	74.125.65.141

Clouds are scaleable infrastructure

- Amazon EC2, 3 locations, limited migration
- Akamai: replication of **static** data
- Google has solved the hard part of scalable application infrastructure: duplication over a large distance. If you can do that, you can deploy **any number** of servers.
- Google App Engine, although fundamentally more powerful and still in beta, is pretty impressive. It is in the same league as most other CDNs.

Need more servers?

Need more servers?

Conclusion

- Clouds are viable infrastructures for internet based services that
  - Are globally distributed
  - Need substantial scaling
- There is a wide range of services
  - Type of content served
  - Geographical reach

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Thank you for your attention

Any Questions?

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