

A nighttime photograph of a city skyline, likely Dubai, featuring a prominent bridge with blue lights and a body of water in the foreground. The skyline includes several tall buildings, one of which is under construction with visible cranes and scaffolding. The image is partially obscured by a dark grey diagonal overlay on the left side.

Context-Aware Analytics: *from Applications to a System Framework*

Min Wang
HP Labs China

Context-Aware Computing: A trend for Next 10 years

- Gartner has identified four broad trends that will change IT and the economy in the next 10 years
 - Cloud
 - Business Impact of Social Computing
 - **Context-Aware Computing**
 - Pattern Based Strategy
- Research focus for HP Labs China in the next three years
- Context
 - Any information that can be used to characterize the situation of an entity [Dey01].
- Context-Awareness
 - The ability of an **application** to understand and use the current context of the users to adapt the application's operations, thereby delivering high quality and well personalized user experience
 - The ability of a **system** to understand and use the current context of the system to adapt the system's operations, thereby achieving high system performance



Outline

- Supporting Context-Awareness: Applications
 - Context-aware web content delivery
 - Context-aware IT support for enterprise users
 - Context-aware network system optimization
- Technical Challenges
- Generic Framework for Context-Aware Computing

Context-Aware Web Content Delivery

Help users consume valuable information on the Web

Web Content Recommendation

Coupon Recommendation

Coupons



INTEREST



Web Printing

Crowd Intelligence Clipping

my-mashUP



HP Print Logs

Parallel Processing for Efficiency



Context-Based Coupon Recommendation

Bio: Chef,
Native New
Yorker

Location: New
York City
Web: <http://www.bobbyflay.com>

2011-4-20 13:47:02:
@FoodNetwork My office, check it
out...
<http://www.youtube.com/watch?v=PmnCJ2AD-Mo>

2011-4-20 12:23:22: Caesar Burger
@bobbysburgerpal this month. 10
days left. Caesar Mayo, Romaine,
Parmesan, black pepper..
<http://twitpic.com/4n5v3q>

2011-4-18 1:01:04: thanks for
watching everyone. #angr

2011-4-18 0:45:51: who's going
home? #angr


2011-4-18 0:41:58: Thanks for all
the sweet comments about Sophie


User interests




How to match
contexts and
contents ?

Coupons

 \$0.50 \$0.50
new
kraft sandwich shop

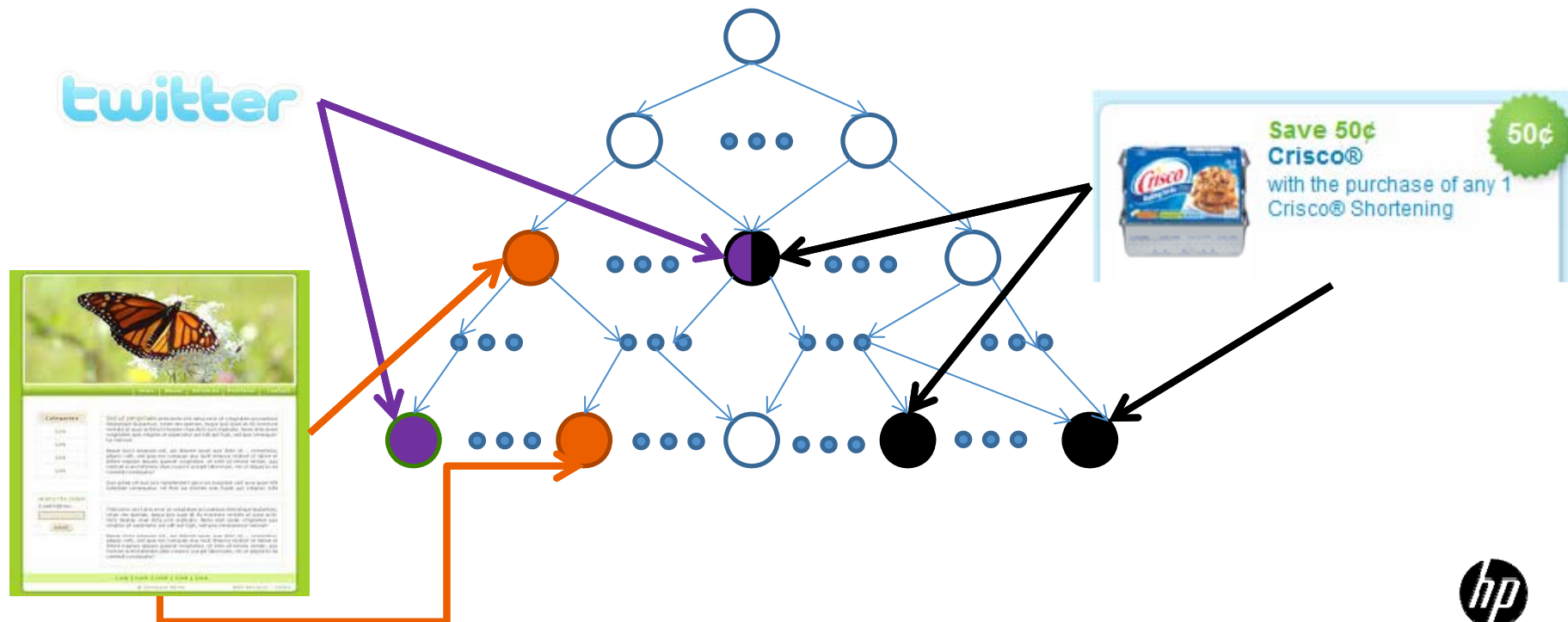
 \$1.00 \$1.00
new
jimmy dean d-lights

 \$1.00 \$1.00
new
hot pockets brand.



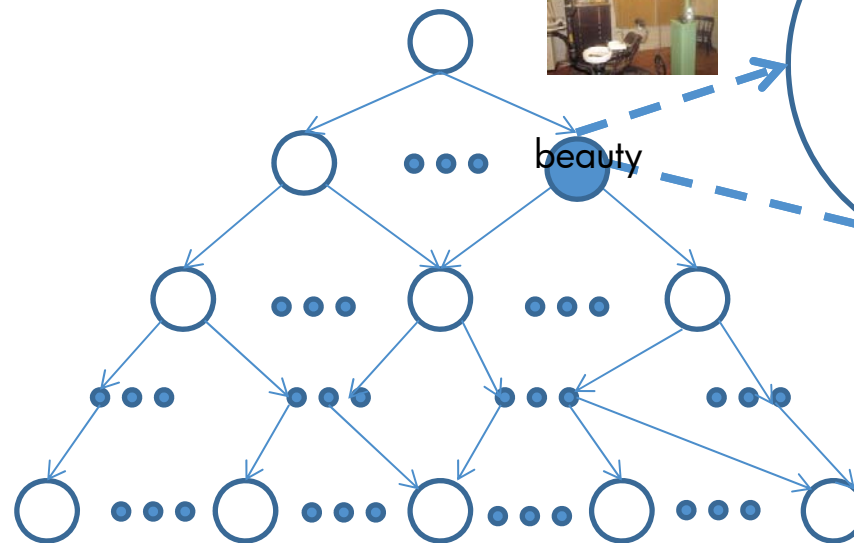
Technical Approach

- Concept taxonomy serves as semantic model
 - Coupon maps to concept nodes (offline)
 - User context maps to concept nodes (online)
 - Graph matching based on concept similarity



7

-

A tube of Colgate Fresh Compound toothpaste, showing the brand name and product type.

pharmacy,
skin care,
vitamins,
hairdressing,

A vitamin is an organic compound required as a nutrient in tiny amounts by an organism. In other words, an organic chemical compound is called a vitamin when it cannot be synthesized in sufficient quantities by...





Bob: I like soft drinks and drink them every day.



HP Smart Print

Preview Coupons Print


Chef Bill's Beef-Barley Soup

Recipe from Midwest Living

Rated: ★★★★★ by 1 person rate 3 ingredients **ON SALE**

0 Share f t Email Print Comment

This main-dish soup, seasoned with fresh herbs and red wine, is quick to make because it uses fast-cooking beef tenderloin.



Prep Time: 30 mins
Total Time: 50 mins
Servings: 8 servings (10 cups)

[Add to Recipe Box](#)
[Add Ingredients to Shopping List](#)

SEE MORE MIDWEST LIVING RECIPES

Ingredients

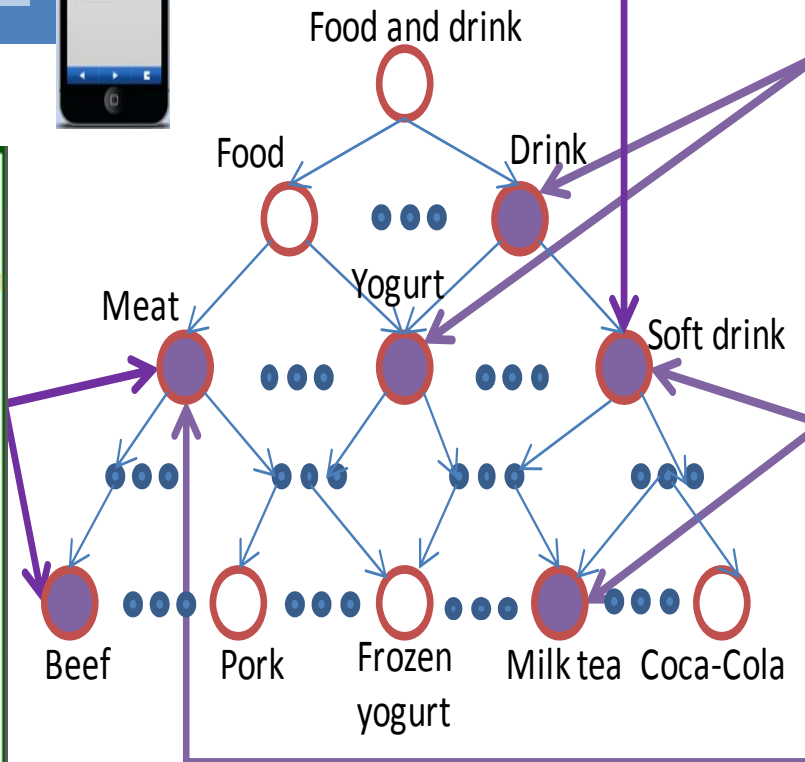
- 1 pound beef tenderloin roast, cut into 3/4-inch cubes
- 1/4 cup olive oil
- 2 cups chopped carrot **ON SALE**
- 1 cup finely chopped celery

RELATED CATEGORIES

- Barley Soup
- Beef Broth and Stock
- Beef Tenderloin
- Carrots
- Celery
- Dutch Oven
- Garlic
- Low Calorie Soups
- Low Carb
- Low Fat Dinners
- Onions
- Quick and Easy Beef Dishes
- Soup for Lunch

RELATED STORIES

- How to Make Chicken Soup
- How to Make Vegetable Soup



voskos greek yogurt

when you buy any one (1)
voskos greek yogurt varieties
(available at kroger)

\$0.75



so delicious?

on one (1) 64 oz. or 32 oz.
unit of so delicious? coconut
milk beverage

\$1.00

Choice Meat Market

\$2.99 sirloin and \$3.99 t-choice meat

\$2.99 sirloin and

\$2.9



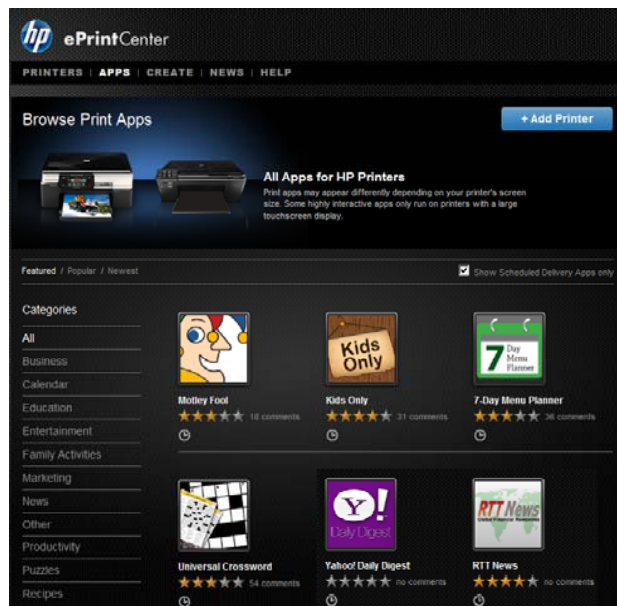
Context-Aware Web Content Delivery

Recommend right web content to right users at right time

Ad/Coupon
Selection

"Print Package"
Recommendation
(frequent print pattern)

Content
Recommendation
e.g., news, magazines,
articles, crosswords, menus



IPG/IWS
Scheduled Delivery



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Context-Aware Enterprise Search

Better enterprise search to help users find solutions for IT problems

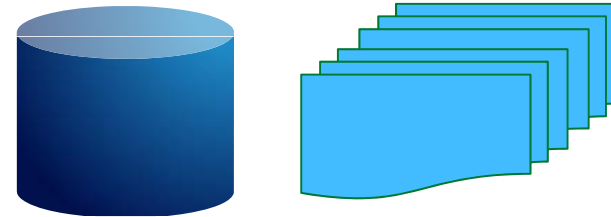


Related Entity Search

Related Queries

Acronym Support

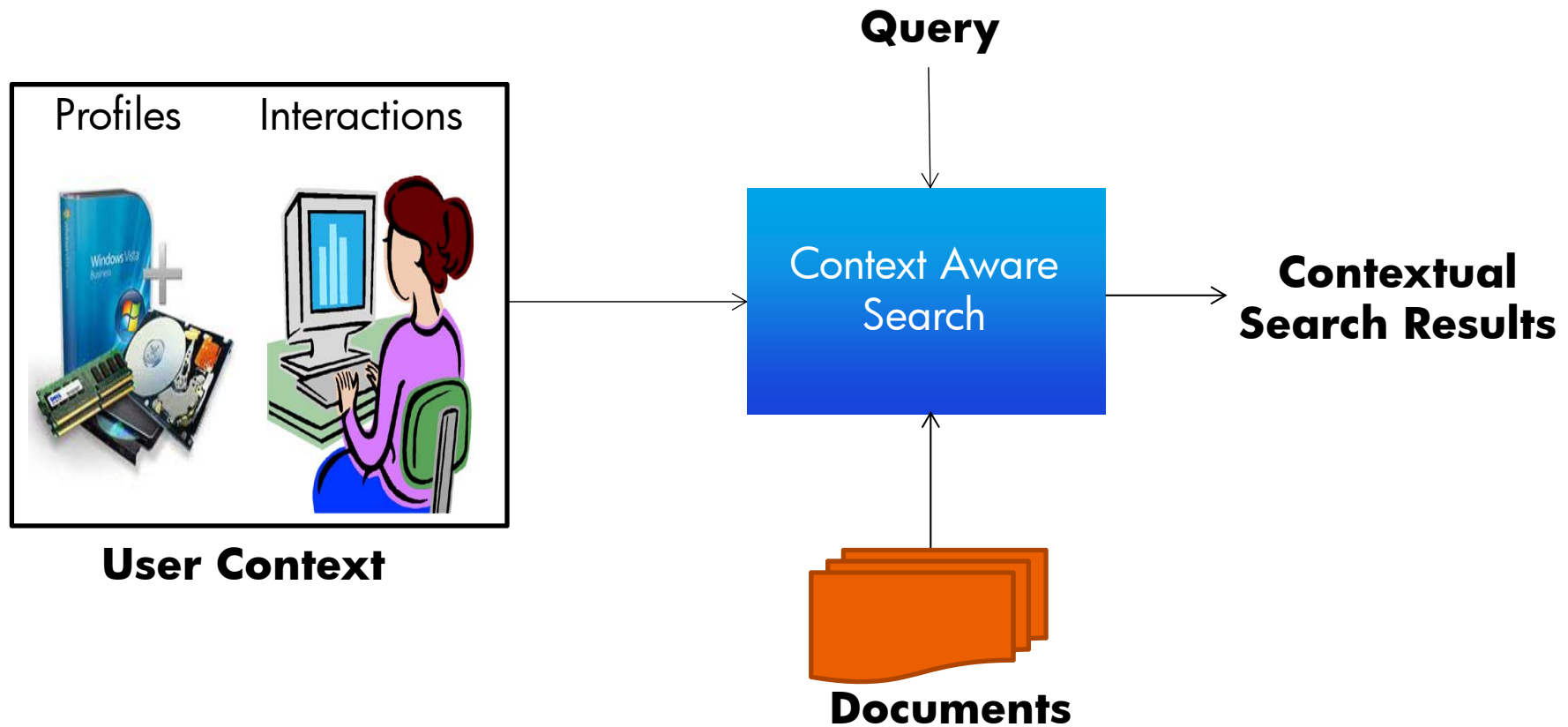
Query Classification



Knowledge for IT Support

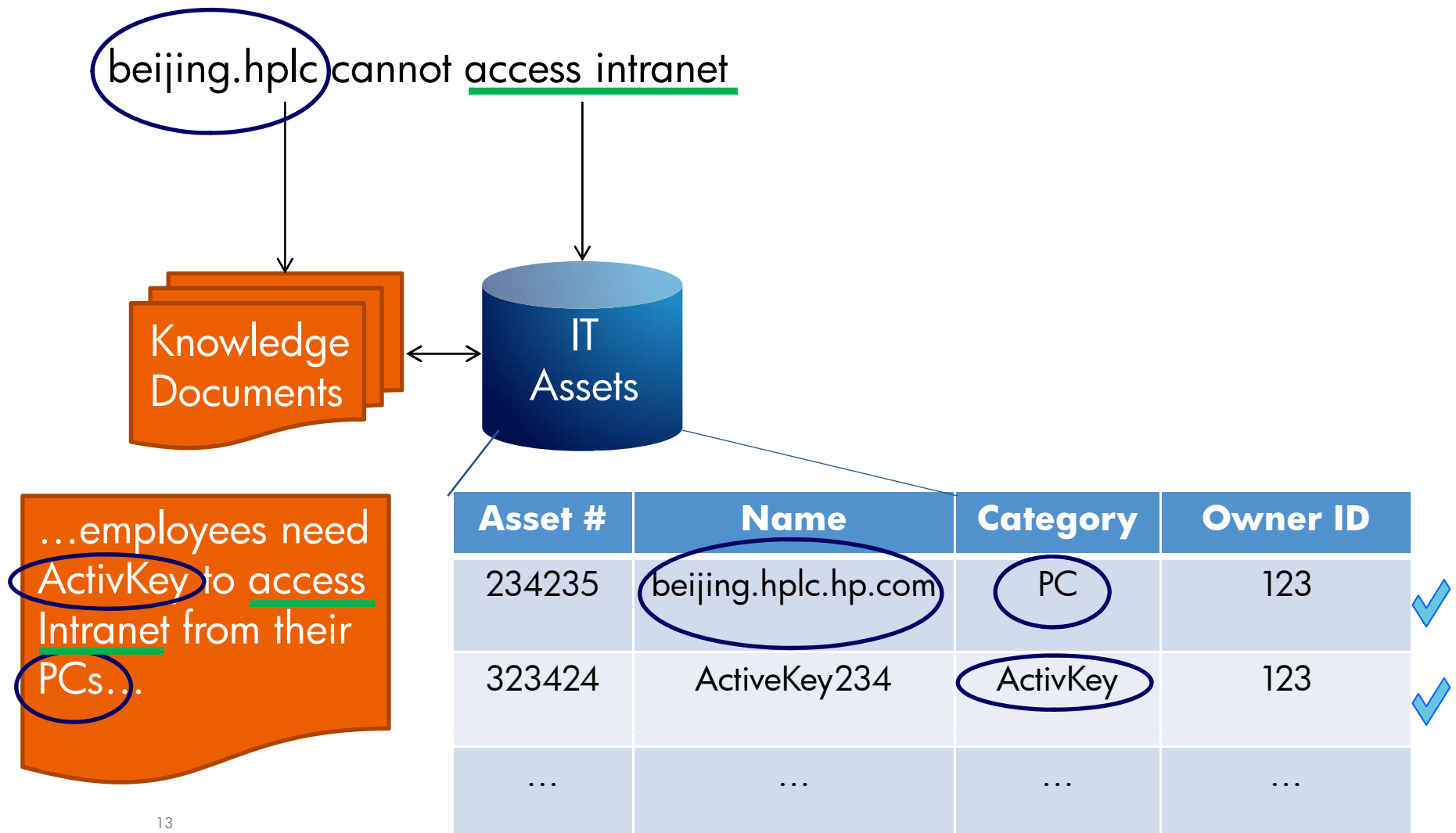


Context-Aware Enterprise Search



Related Entity Search

Finding query relevant entities using structured and unstructured data

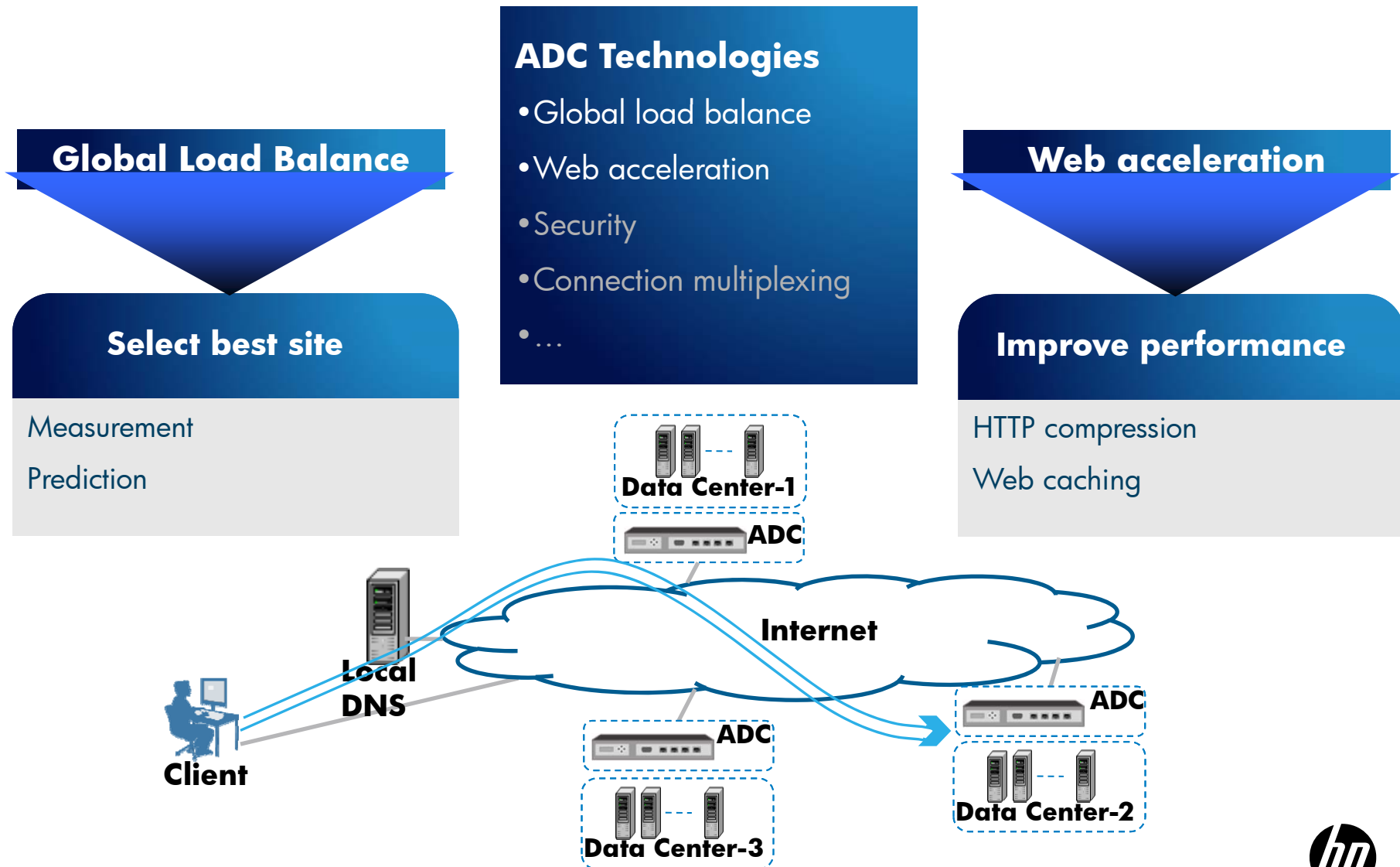


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Networking: Optimization for Application Delivery Controller

Optimize response time, increase availability/scalability of networked applications



Context-Aware Network System Optimization

Bring intelligence into network services to improve performance and reduce cost by leveraging system, network and application/user context

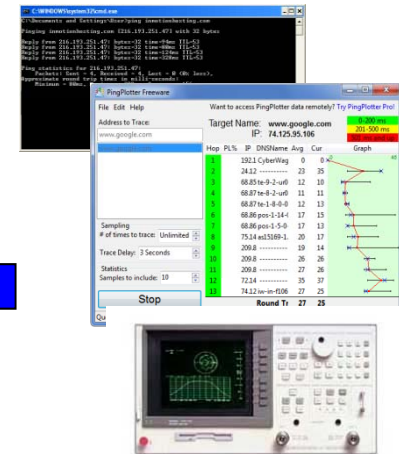
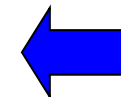
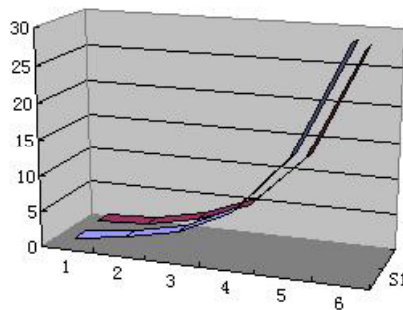
Application Delivery Controller (ADC)

Context-aware
global load balance

Context-aware
web acceleration

*System, network & app/user
contexts*

Performance



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➡ Technical Challenges

- Generic Framework for Context-Aware Computing



Technical Challenges

- Context collection
 - Context inference
 - Context collection through online game
- Wide variety of context types and data formats
 - Social media contents, web pages, user profile information, etc.
 - Combine knowledge from both structured and unstructured data
- Content-context mapping
 - Very different from join operation in DBMS
 - A diverse set of context modeling approaches
 - Ontology based semantic model
 - Page structure based model
 - Co-occurrence based syntactic model

Technical Challenges (cont.)

- Context relevance ranking
- Context freshness
- Context consistency
- Privacy concerns
 - Context collection, usage, and sharing
 - Investigate anonymization
- Performance
- Scalability
- Evaluation



Outline

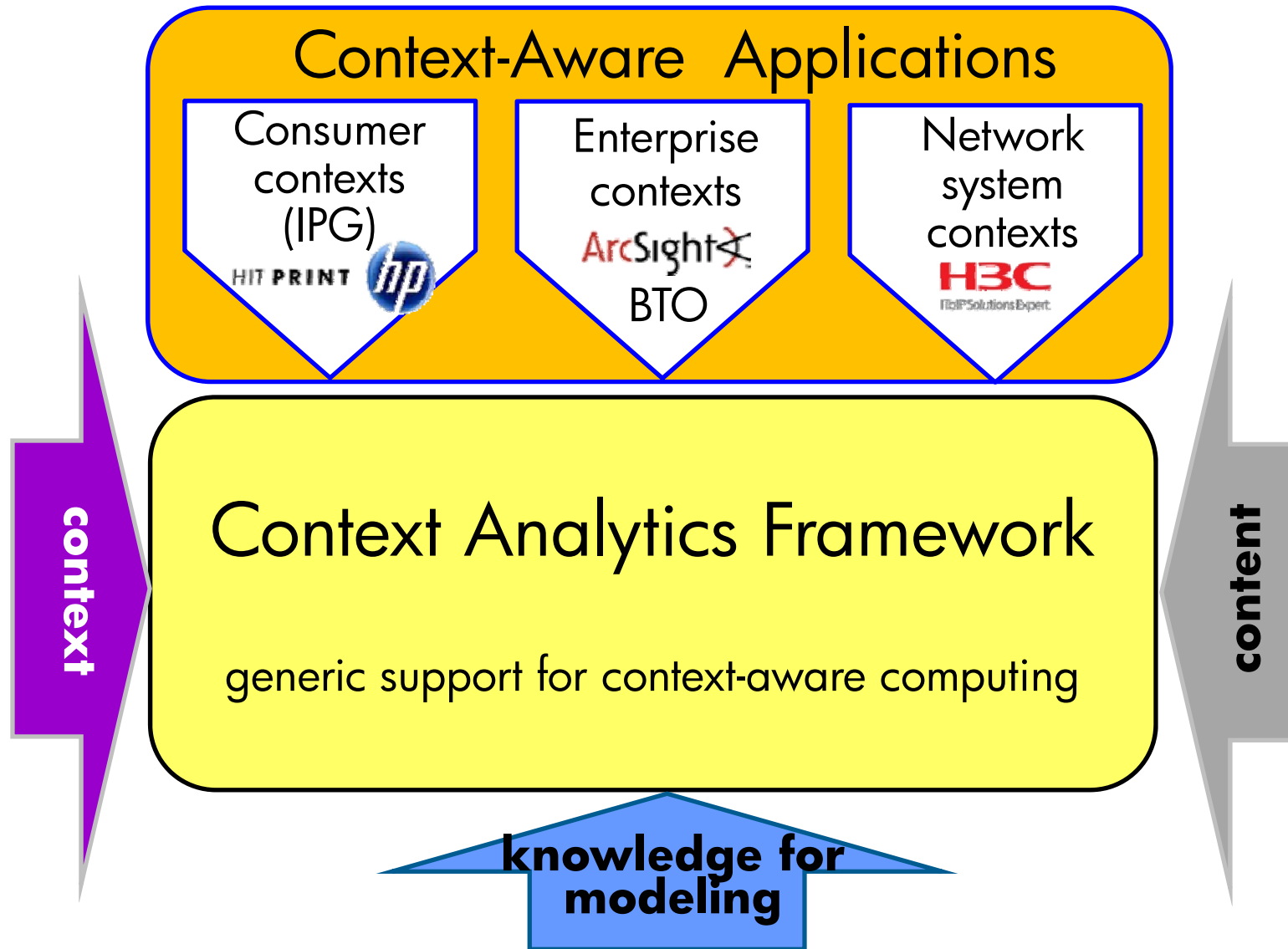
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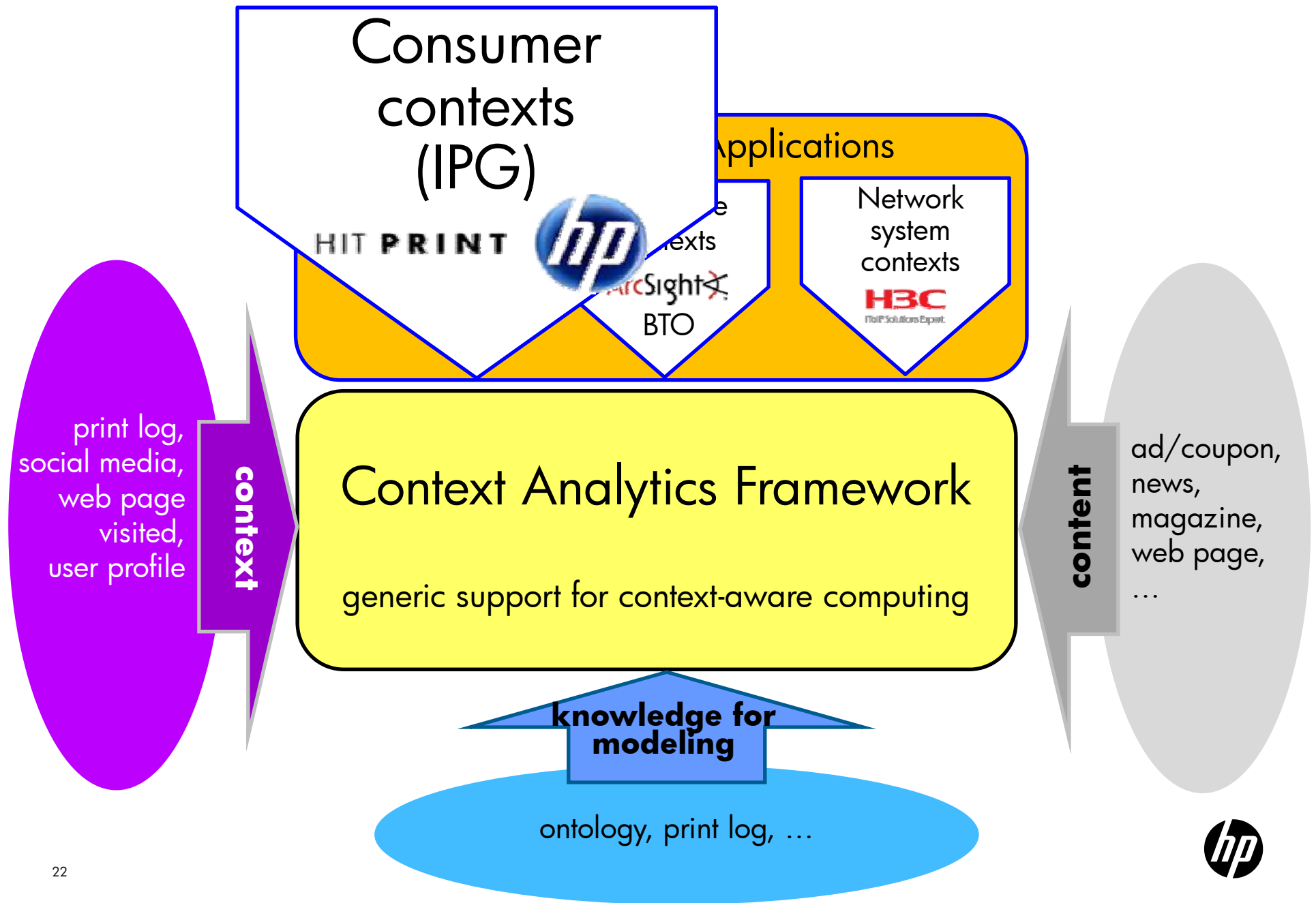
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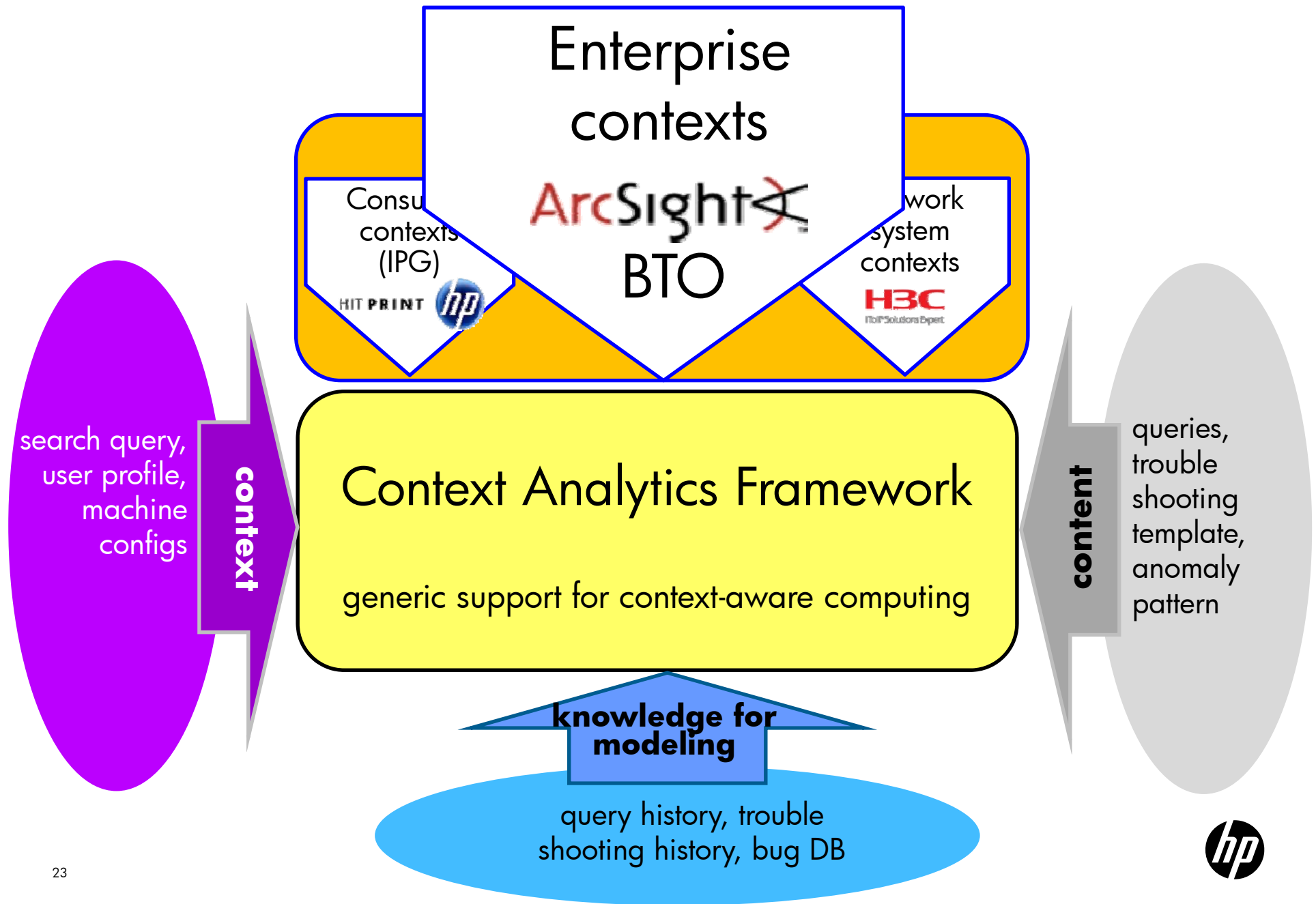
- Technical Challenges

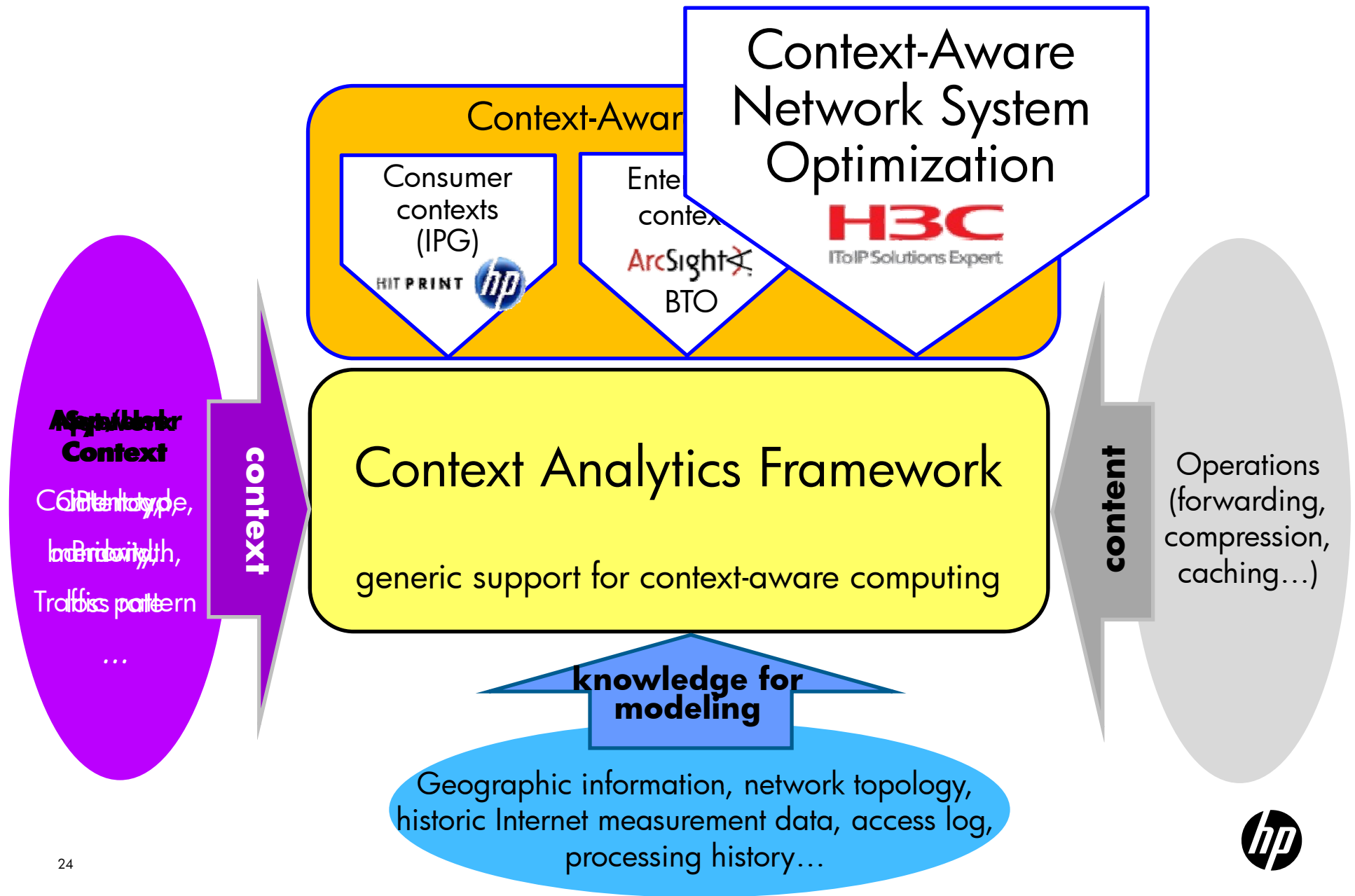
➡ Generic Framework for Context-Aware Computing

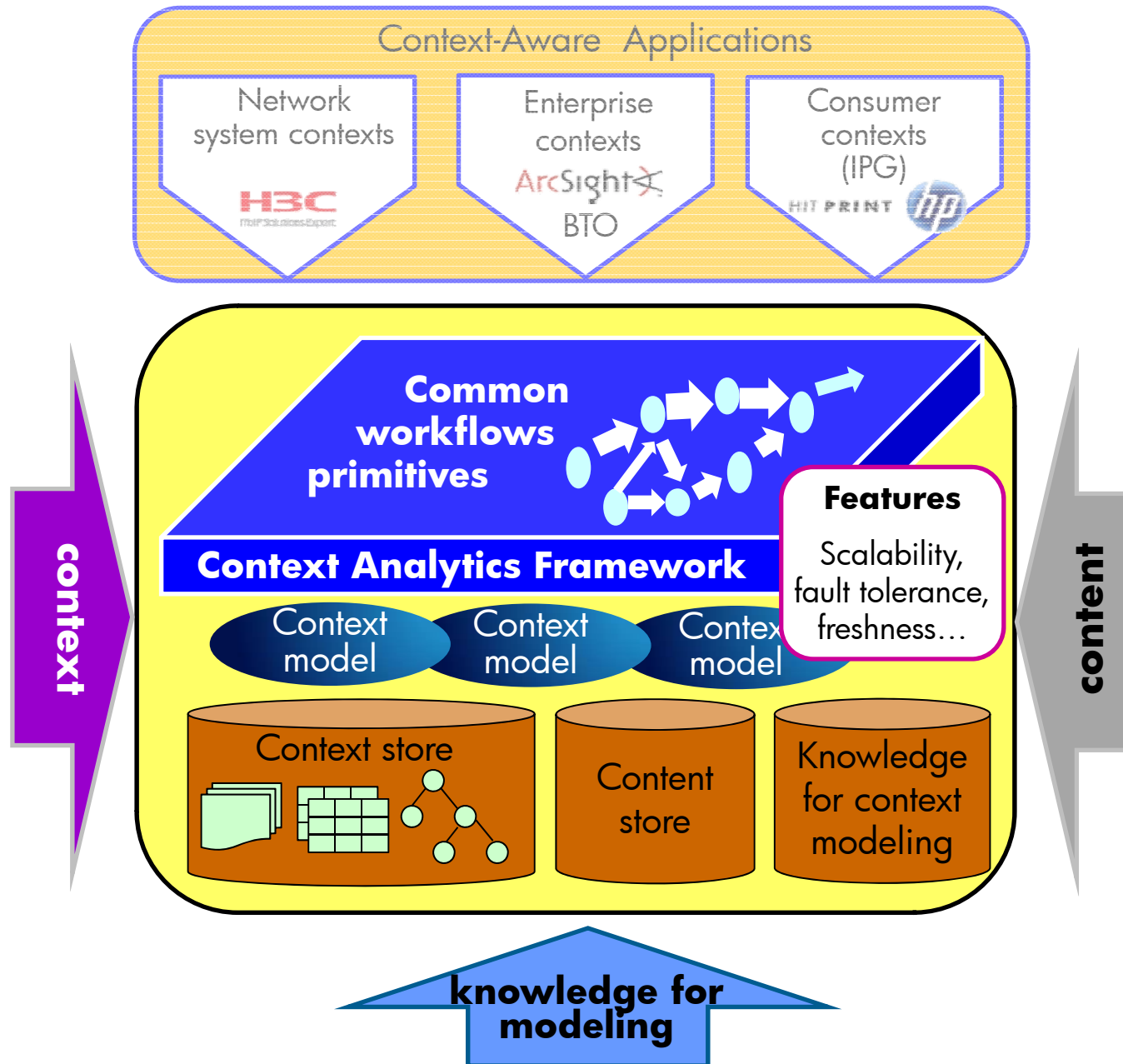
CONTEXT ANALYTICS









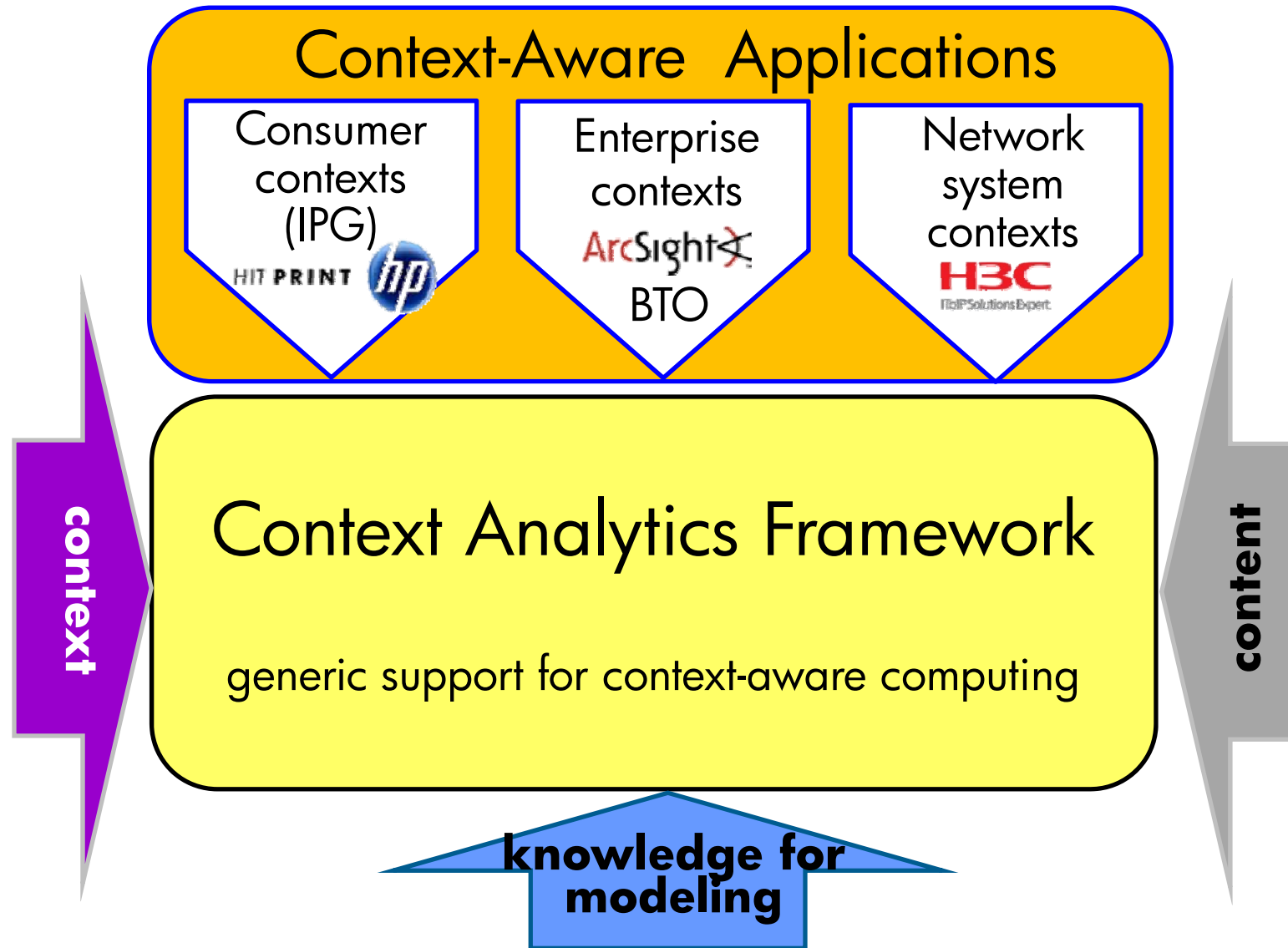


System Framework: Technical Challenges

- Identifying common primitives and work flows
 - Application studies
- Balancing generality, usefulness, and efficiency
 - First support three application studies, then generalize to wider scope
 - Low-level primitives + operators for popular context models
- Realizing common support for parallel processing, fault tolerance, and context freshness
 - Question: how to divide the data and computation?
 - Investigate a combination of MapReduce and database techniques



CONTEXT ANALYTICS



Thanks!



Q & A

