ORACLE

Securing Property Graphs with Oracle Label Security

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Spatial and Graph Product Management
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AskTOM Office Hours: Graph Database and Analytics

- Welcome to our AskTOM Graph Office Hours series!
  We're back with new product updates, use cases, demos and technical tips
  https://asktom.oracle.com/pls/apex/asktom.search?oh=3084
- Sessions will be held about once a month
- **Subscribe** at the page above for updates on upcoming session topics & dates
  And submit feedback, questions, topic requests, and view past session recordings
- Note: **Spatial** now has a new Office Hours series for location analysis & mapping features in Oracle Database:
  https://asktom.oracle.com/pls/apex/asktom.search?oh=7761

The Demo: One graph, 3 users each with different access

```
SQL> conn jayant@og202007291226_low
Password? (**********?) ************
Connected.
SQL> pgql auto on graph bank_graph_pg

PGQL Auto enabled for graph=[BANK_GRAPH_PG], execute=[true], translate=[false]
PGQL> select count(v) as NumAccounts match (v) ;
  NumAccounts
_____________
1000

PGQL> select min(e.AMOUNT), max(e.AMOUNT) match ()-[e]->();
  min(e.AMOUNT)    max(e.AMOUNT)
_________________  _________________
1000               100000
```

The Demo: One graph, 3 users each with different access

```
SQL> conn jim@og202007291226_low
Password? (**********?) ************
Connected.
SQL> pgql auto on

PGQL Auto enabled for graph=[null], execute=[true], translate=[false]
PGQL> select count(v) as NumAccounts from match (v)  on jayant.bank_graph_pg;
  NumAccounts
_____________
990

PGQL> select min(e.AMOUNT), max(e.AMOUNT) from match ()-[e]->() on jayant.bank_graph_pg;
  min(e.AMOUNT)   max(e.AMOUNT)
_______________ _______________
1000            100000
```

The Demo: One graph, 3 users each with different access

```
SQL> conn hans@og202007291226_low
Password? (**********?) ************
Connected.
SQL> pgql auto on

PGQL Auto enabled for graph=[null], execute=[true], translate=[false]
PGQL> select count(v) as NumAccounts from match (v)  on jayant.bank_graph_pg ;
  NumAccounts
_____________
980

PGQL> select min(e.AMOUNT), max(e.AMOUNT) from match ()-[e]->() on jayant.bank_graph_pg ;
  min(e.AMOUNT)    max(e.AMOUNT)
_________________  _________________
```

Agenda

1. Property Graph support in the database
2. Demo Scenario
3. Demo
4. Q&A

Product Overview: Graph Database and Analytics

Graph data model: A different way to model your data

Property Graph Feature in Oracle Database:

Enterprise capabilities

Highly scalable

- In-memory query and analytics and in-database query
- 10s of billions of edges and vertices

PGQL: Powerful SQL-like graph query language

Analytics Java API: 50+ pre-built graph analysis algorithms

Visualization

- Light-weight web application, UI accessible from a browser

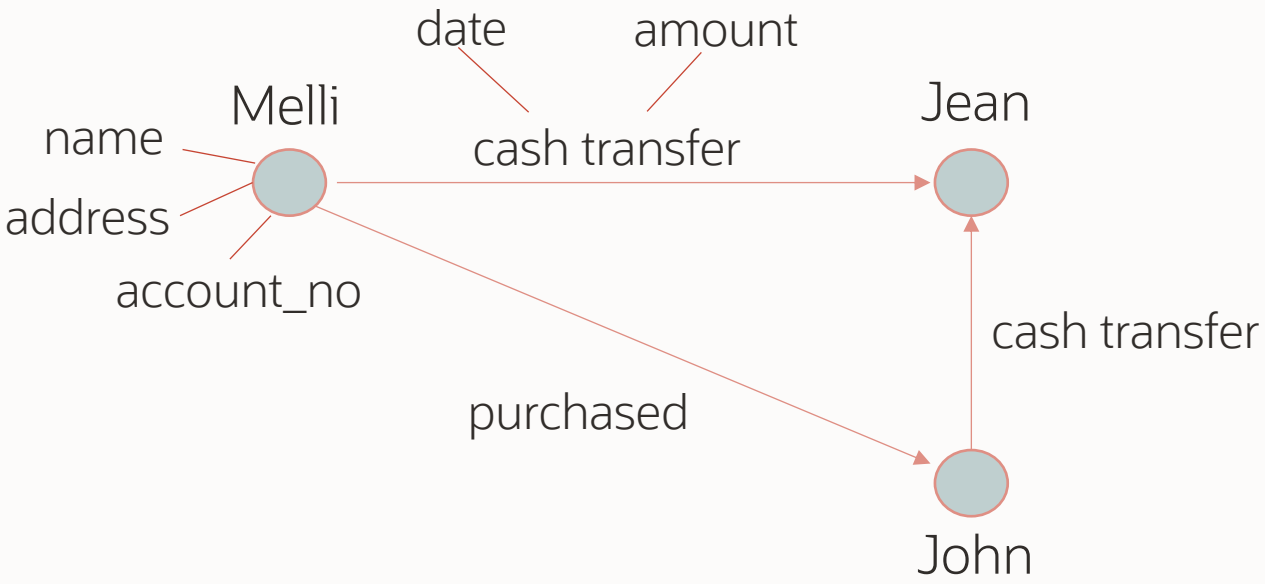
Graph Applications:

- Financial
- Law enforcement and security
- Manufacturing
- Public sector
- Pharma

and more

What is a Graph?

A collection of points (vertices/nodes) and lines between those points (edges)



Create a Graph from Database Tables

ACCOUNTS

ACCT_ID
0
1
2
3
4
5
…

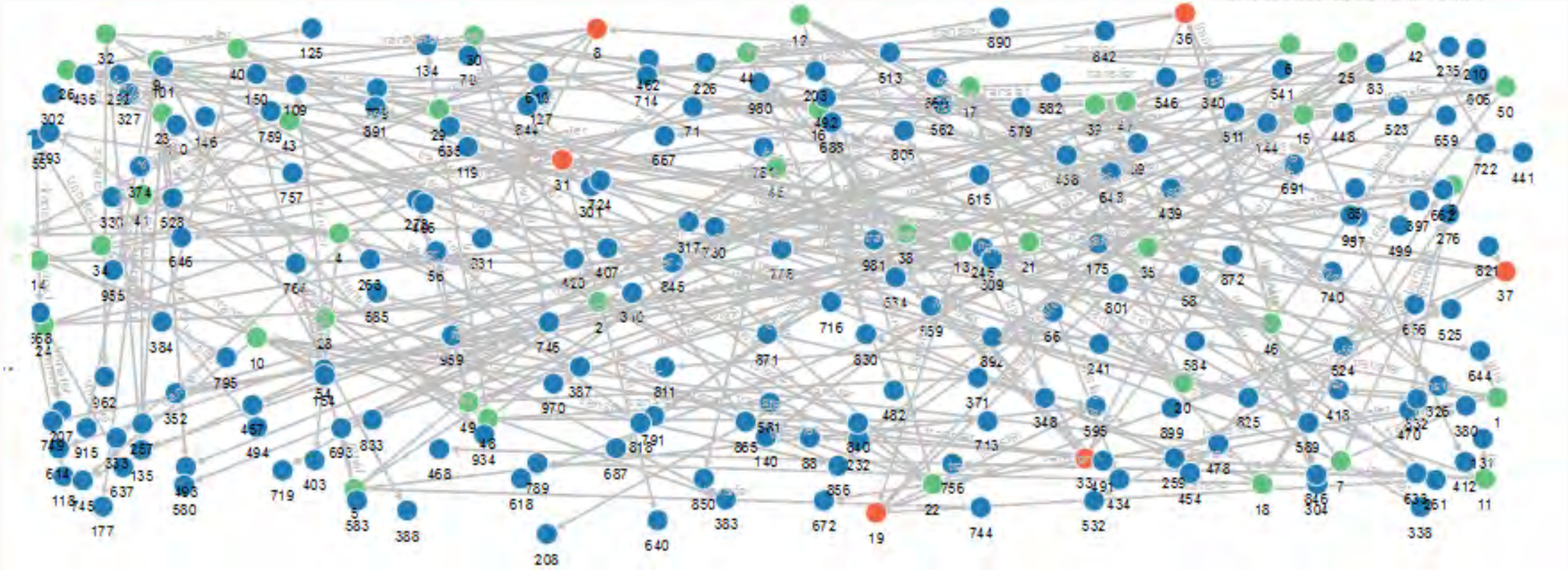
TRANSACTIONS

FROM_ACCOUNT	TO_ACCOUNT	AMOUNT
1	672	1000
1	584	1000
1	259	100000
2	833	5001
2	840	7050
2	493	4363
…	…	…

PGQL DDL SYNTAX:

```
CREATE PROPERTY GRAPH bank_graph
  VERTEX TABLES (
    ACCOUNTS LABEL Account PROPERTIES ( ACCT_ID )
  )
  EDGE TABLES (
    TRANSACTIONS
      SOURCE KEY ( FROM_ACCOUNT ) REFERENCES ACCOUNTS
      DESTINATION KEY ( TO_ACCOUNT ) REFERENCES ACCOUNTS
      LABEL transfer PROPERTIES ( AMOUNT )
```

Cash Transfer Graph

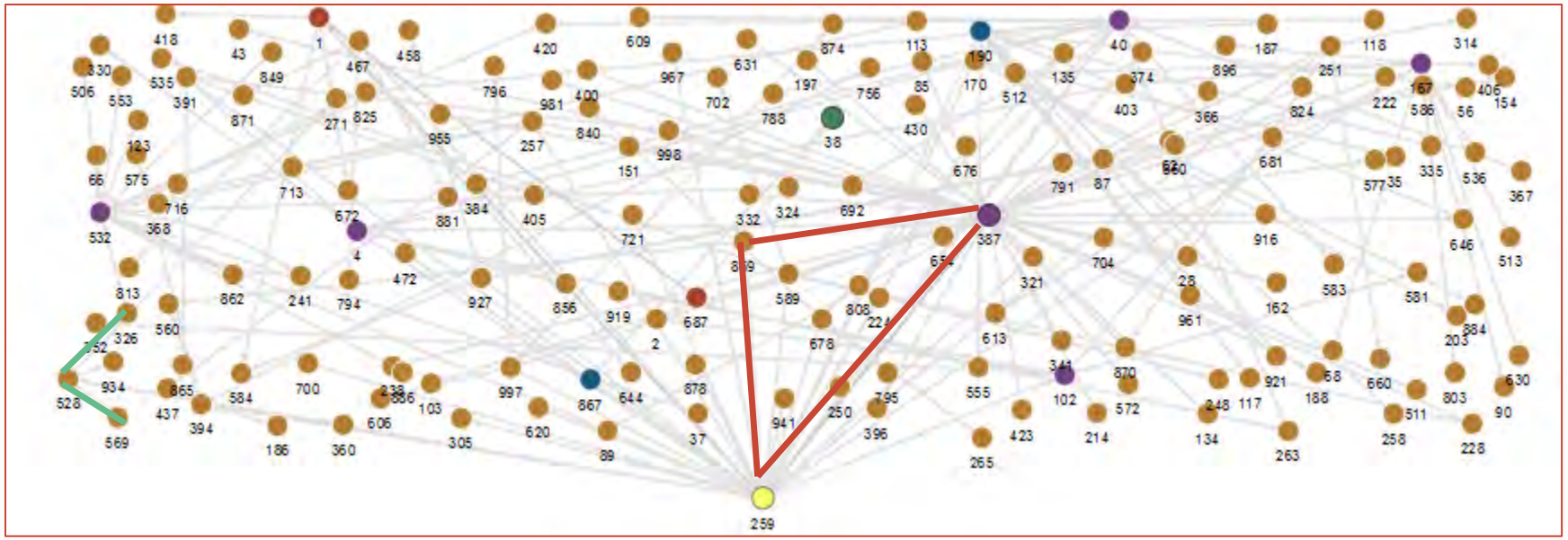


Graph Queries: Finding Patterns in a Graph

Is there a pattern that connects 528 to 326 and 569?

Property Graph Query Language (PGQL)

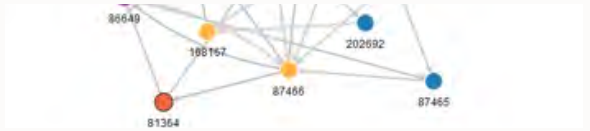
```
SELECT v1, v2, v3, e1,e2
MATCH (v1)-[e1]->(v2),
MATCH (v1)-[e2]->(v3)
where v1.id=528 and v2.id=326 and v3.id=569
```



Graph Queries: Finding Patterns in a Graph

Cycles


```
SELECT v1, v2, v3, e1,e2,e3
MATCH (v1)-[e1]->(v2)-[e2]->(v3)-[e3]->(v1)
```

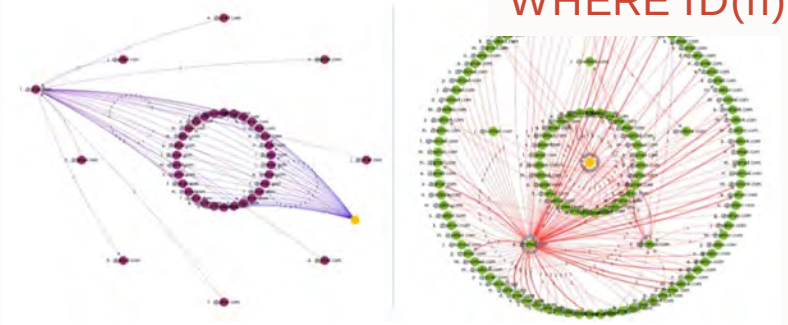


Paths

```
SELECT *
MATCH (n)-/:transfer{1,6}/->(m)
WHERE ID(n) = 1
```

```
SELECT n, ARRAY_AGG(ID(m)), ARRAY_AGG(ID(e))
MATCH TOP 2 SHORTEST ((n) (-[e:transfer]->(m))* (n))
WHERE ID(n) = 1
```

Patterns



Product Overview:

Oracle Label Security

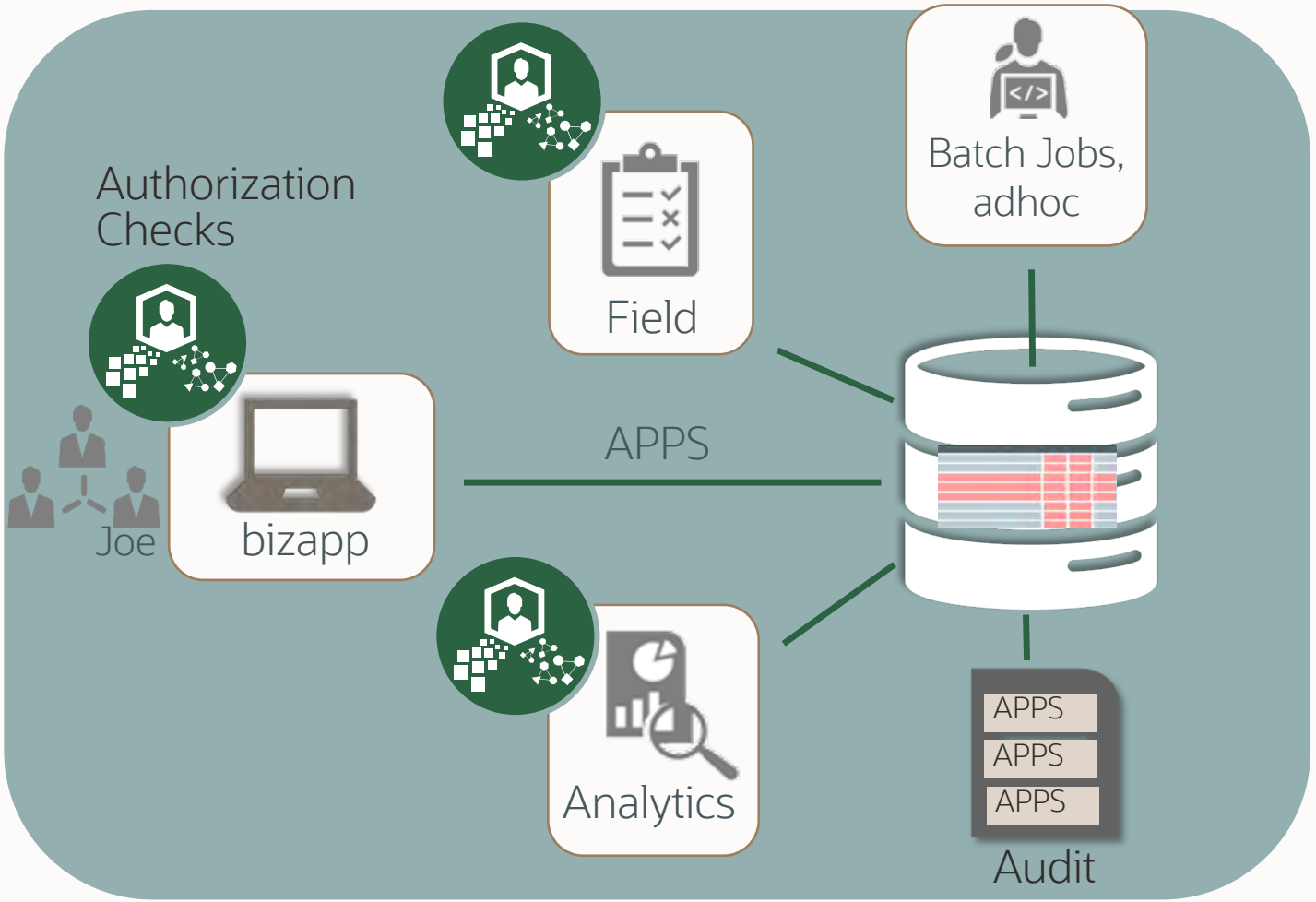
What is Application Data Security?

Application data Security is about the rules for which users can access what data

- Employees can view public information
- An employee can view own record, update contact information
- Manager can view salary of his/her reports

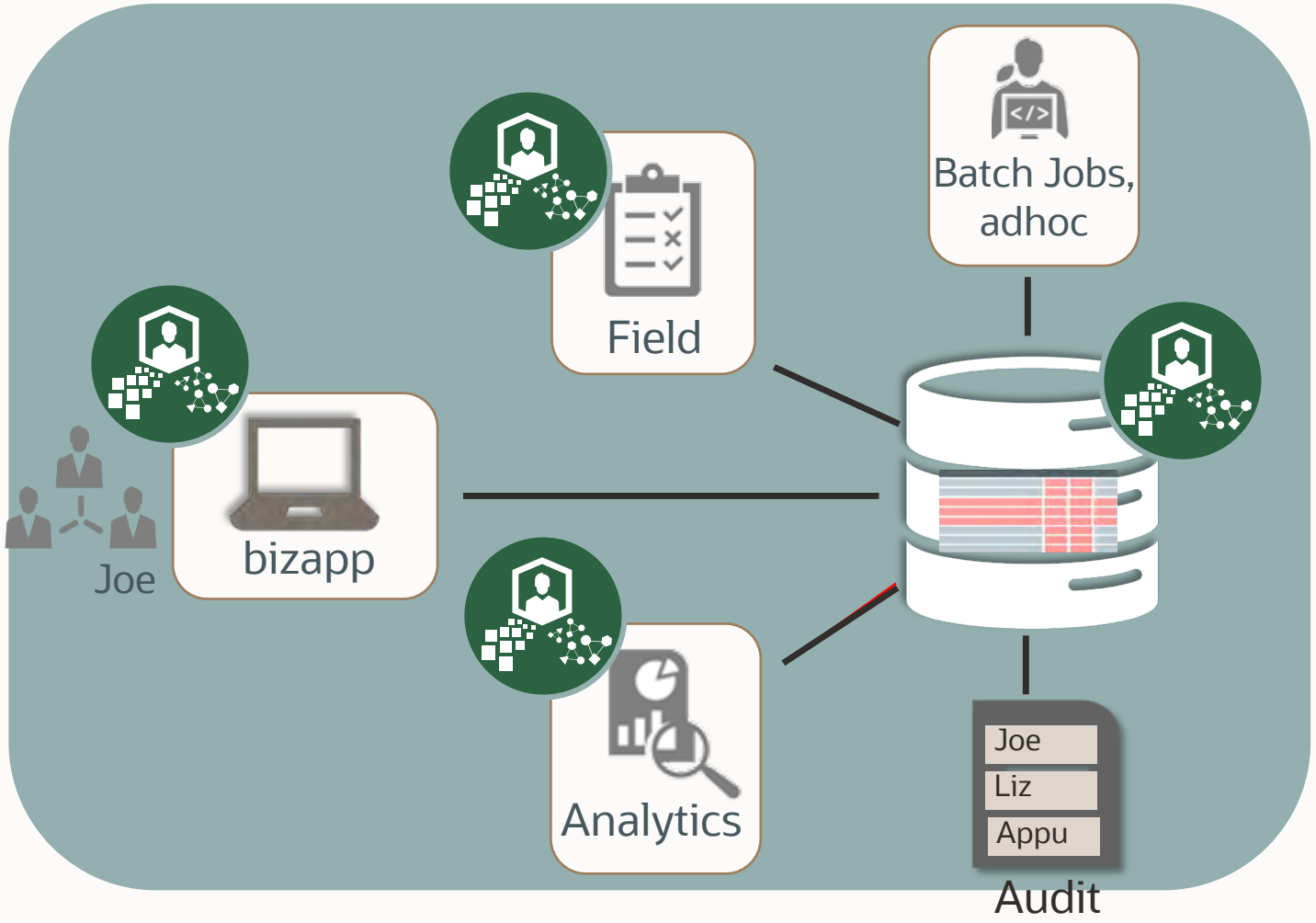
Name	Manager	SSN	Salary	Phone Number
Adam	Steven			515.123.4567
Neena	Steven			515.123.4568
Nancy	**Neena**	**108-51-4569**	**12030**	**650.111.3300**
Luis	Nancy		6900	515.124.4567
John	Nancy		8200	515.124.4269
Daniel	Nancy		9000	515.124.4469

Challenges with Application Data Security



- Security checks embedded in application logic
- High risks with big-user connection
- Fragmented security
- Data not protected from direct connection
- No application user audit
- Complex development and maintenance

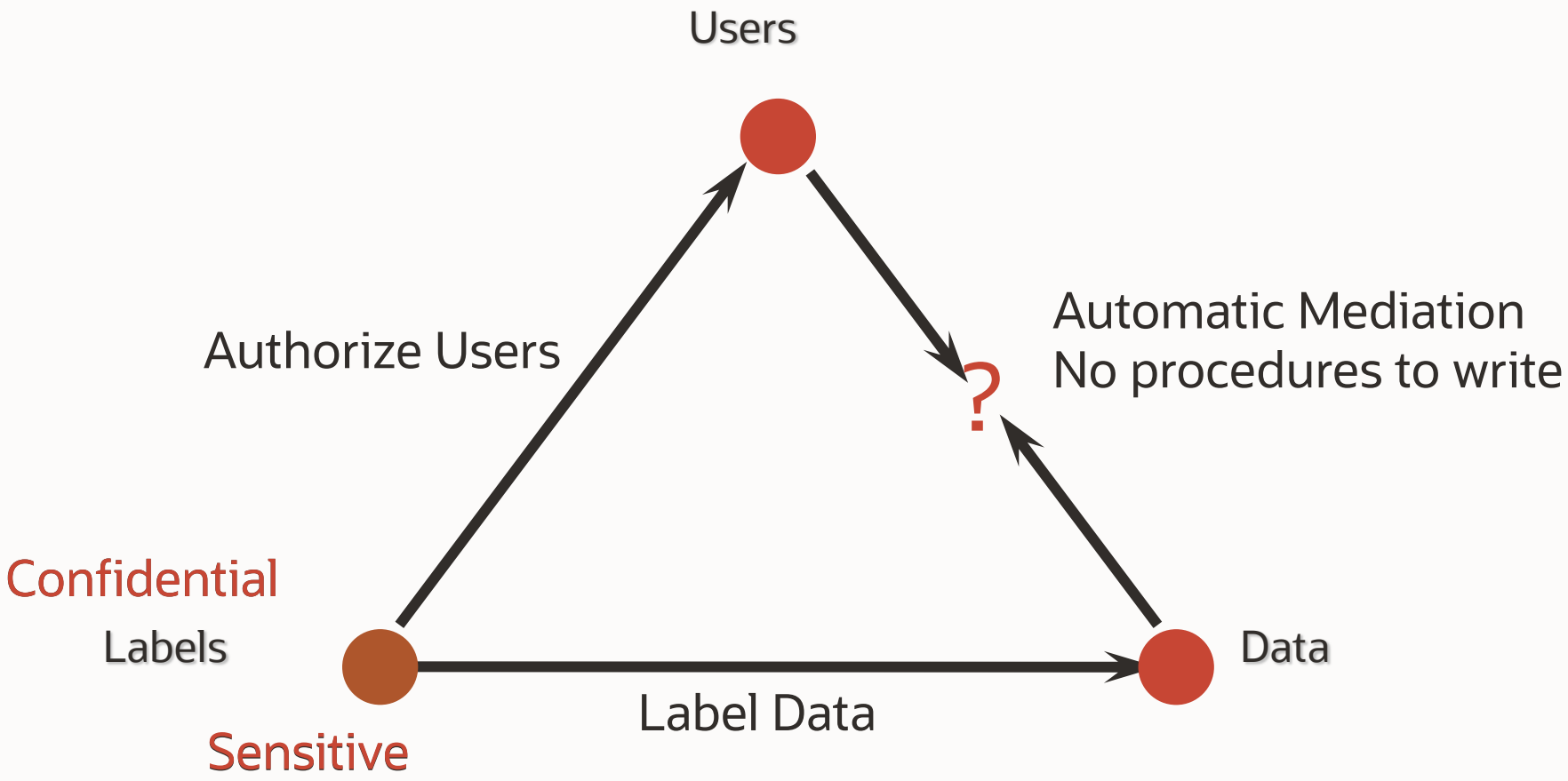
Centralized Application Data Security



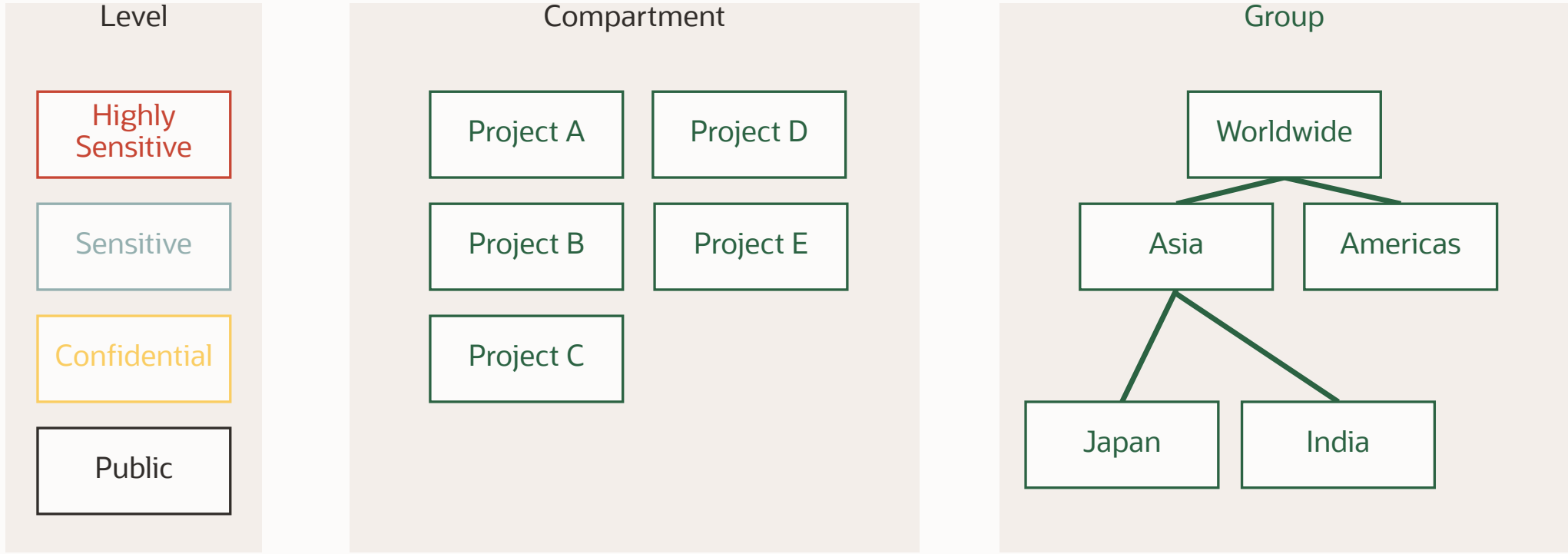
Highlights

- Application user session propagation to the database
- Data security based upon application users, role, privileges, and various relationships
- Centralized data access security controls
- Security enforced for all connections
- Audit of application user activity
- Simplified administration with declarative security

Oracle Label Security – User and Data Labels



Understanding a Label

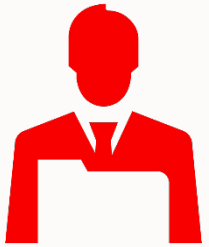


Oracle Label Security Example

```
SQL> select name, budget, status, announce from projects;
```

Project Data

Name	Budget	Status	Announce	Label
Drug A	$1.5M	Green	2/1/2019	HS:A:
Drug B	$4 M	Red	2/15/2019	HS:B:
~~Drug C~~	~~$.5 M~~	~~Red~~	~~4/1/2019~~	~~HS:C:~~
Drug D	$1.7 M	Yellow	11/1/2019	HS:D:
~~Drug E~~	~~$4 M~~	~~Yellow~~	~~8/1/2019~~	~~HS:E:~~



User Label
HS:A,B,D:

Oracle Label Security Example

```
SQL> select name, budget, status, announce from projects;
```

Project Data

Name	Budget	Status	Announce	Label
Drug A	$1.5M	Green	2/1/2019	HS:A:
Drug B	$4 M	Red	2/15/2019	HS:B:
Drug D	$1.7 M	Yellow	11/1/2019	HS:D:

OLS retrieves authorized data records only

Demo

Scenario and Steps

Demo Scenario

- Graph of bank accounts and money transfers between those accounts
- Accounts (and corresponding transfers) have a data classification
  - Highly Sensitive, Sensitive, Unclassified
- 3 users: Jayant, Jim, Hans.
  - Jayant owns the data
  - Hans can only see Unclassified data (accounts and transfers)
  - Jim can see Sensitive and Unclassified data
- Oracle Label Security is applied to the graph data

Demo Steps

Label Security portion:

- Create a Label Security Policy
- Define the data classification levels and labels
- Define the user's access rights
- Apply the policy on the relevant tables
- Set the row labels, i.e. data classifications
- Verify that the policy is enforced

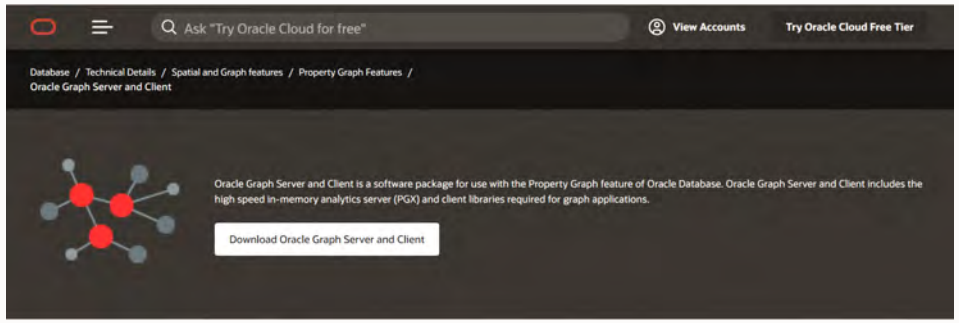
Property Graph portion:

- Grant access to the property graph to other users (Jim, Hans)

Demo

Helpful Links

Search for "Oracle Graph Server and Client" to download from oracle.com



- Graphs at Oracle
  https://www.oracle.com/goto/graph
- Oracle Property Graph
  http://www.oracle.com/goto/propertygraph
- Blog: Examples, Tips and Tricks
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Thank You

Melliyal Annanalai and Jayant Sharma
Product Managers

Our mission is to help people
see data in new ways, discover insights,
unlock endless possibilities.

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