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HUSTEF
Hungarian Software Testing Forum

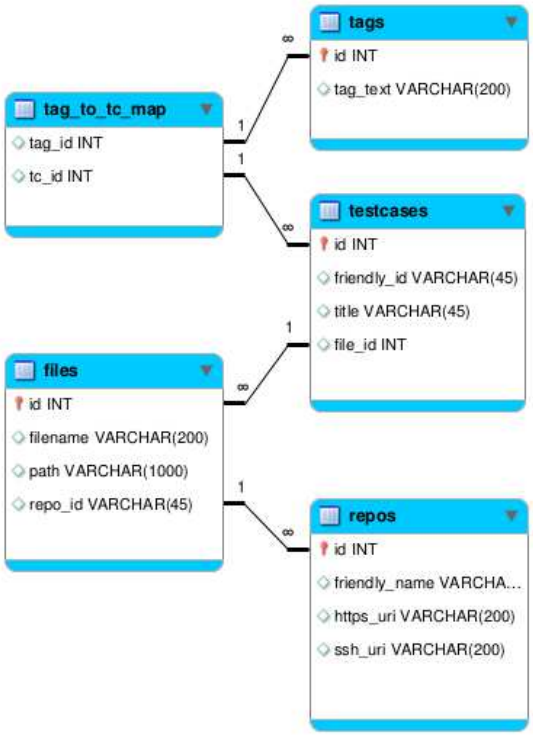
Introduction to graph databases

Why you might find them useful...

- Tóth Attila

- HUSTEF, October 24-25, 2016, Budapest

So far ...
... we used relational databases



RDBMS

- Data in predefined schema
- Data in rows scattered to tables
- Relation ensured via (unique) keys
- Search is accelerated with indexes

Now we have …
… graph databases as well

An exciting (new) technology to store and visualize data

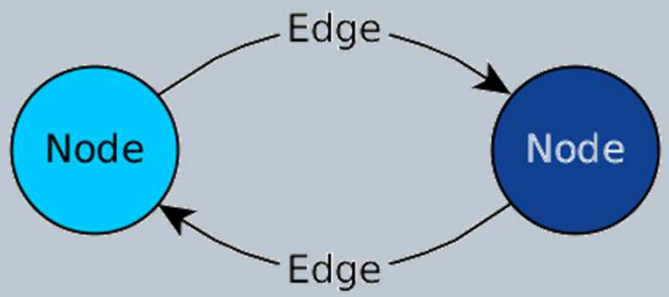
Storage

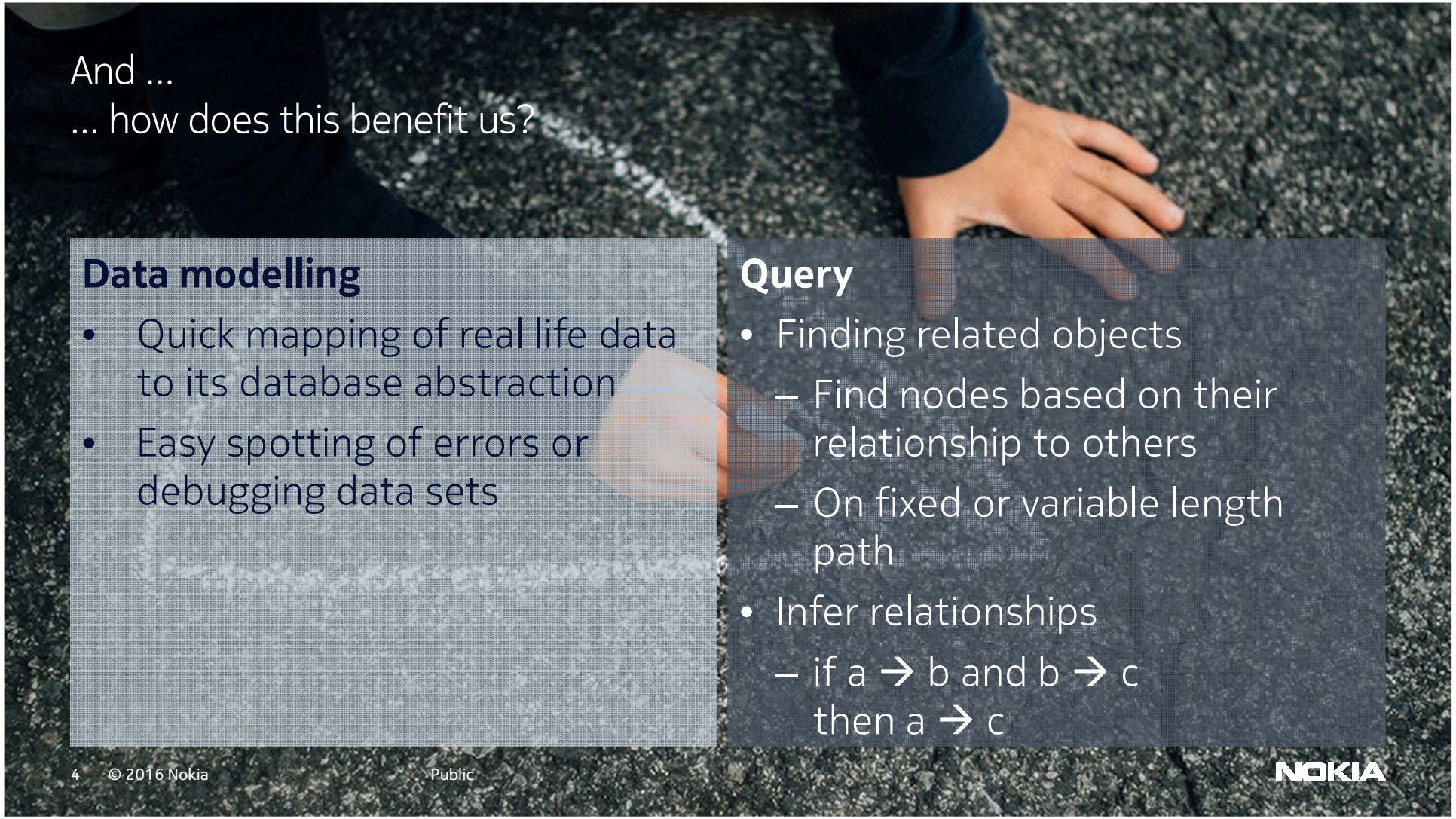
The data is mapped to

- Nodes: objects of data
- Edges: relationship between nodes
- Properties: data assigned to nodes or edges

Visualization

- Table view
- Graphical representation





And ...
... how does this benefit us?

Data modelling

- Quick mapping of real life data to its database abstraction
- Easy spotting of errors or debugging data sets

Query

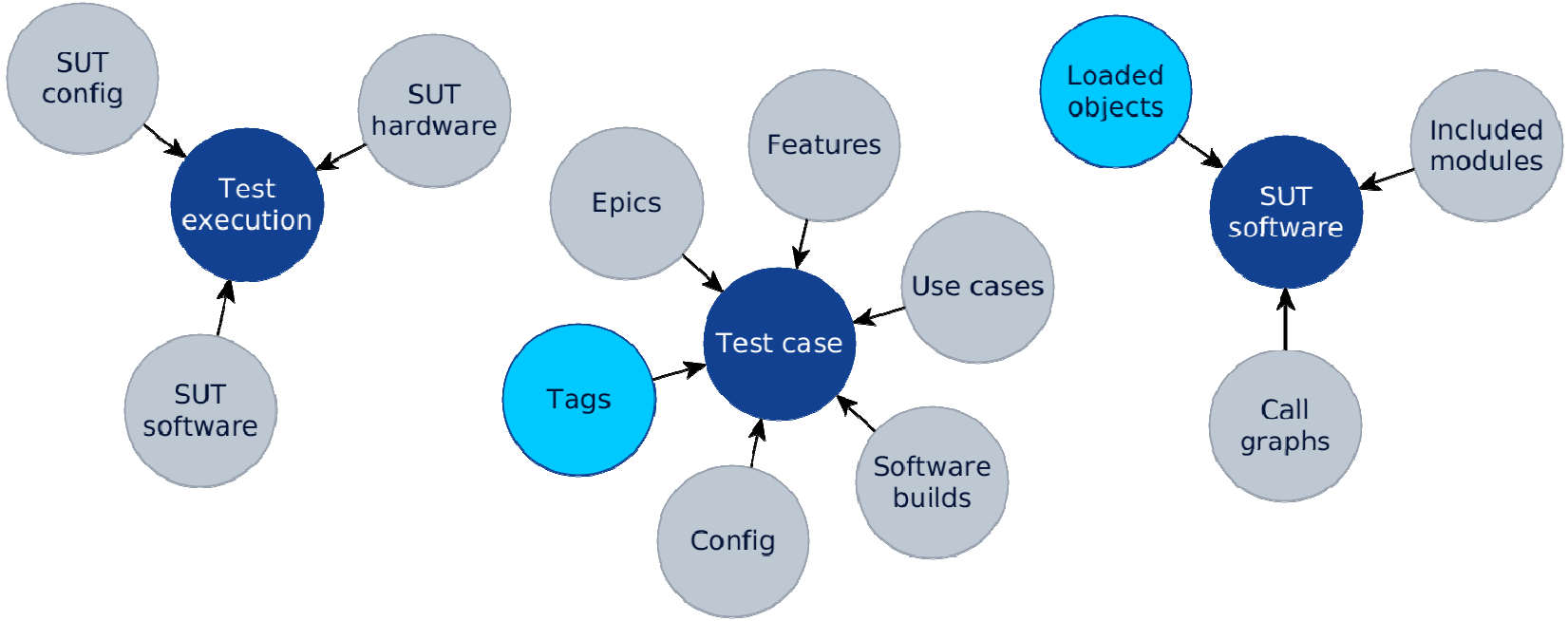
- Finding related objects
  - Find nodes based on their relationship to others
  - On fixed or variable length path
- Infer relationships
  - if a → b and b → c then a → c

From where ...
... it might sound familiar

Graph representation has been in use for a long time

So let us make use of it ...
... for testing

We also have a number of objects that are related to each other



Example 1: Test cases and tags
Background

Problem

- Feature related test cases are executed only in a certain release
- Subset is added to regression set
- ”Rest” could be used targeted
- Automatic selection is needed

Test scripts

- Different test levels and SUT config
- Scattered to multiple repositories and files
- Use different test tools

Solution

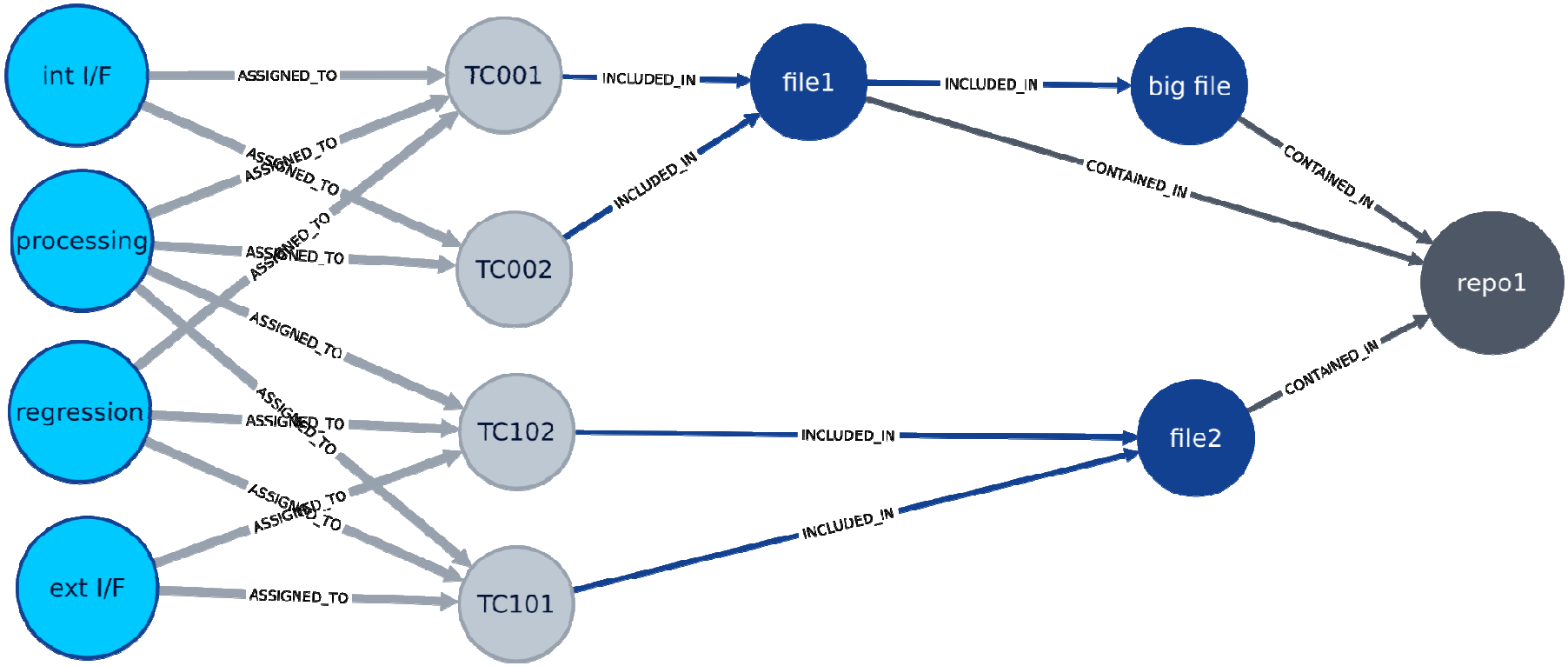
- Tag test cases
- Create test sets dynamically based on chosen tags using graph DB

Example 1: Test cases and tags
Database schema

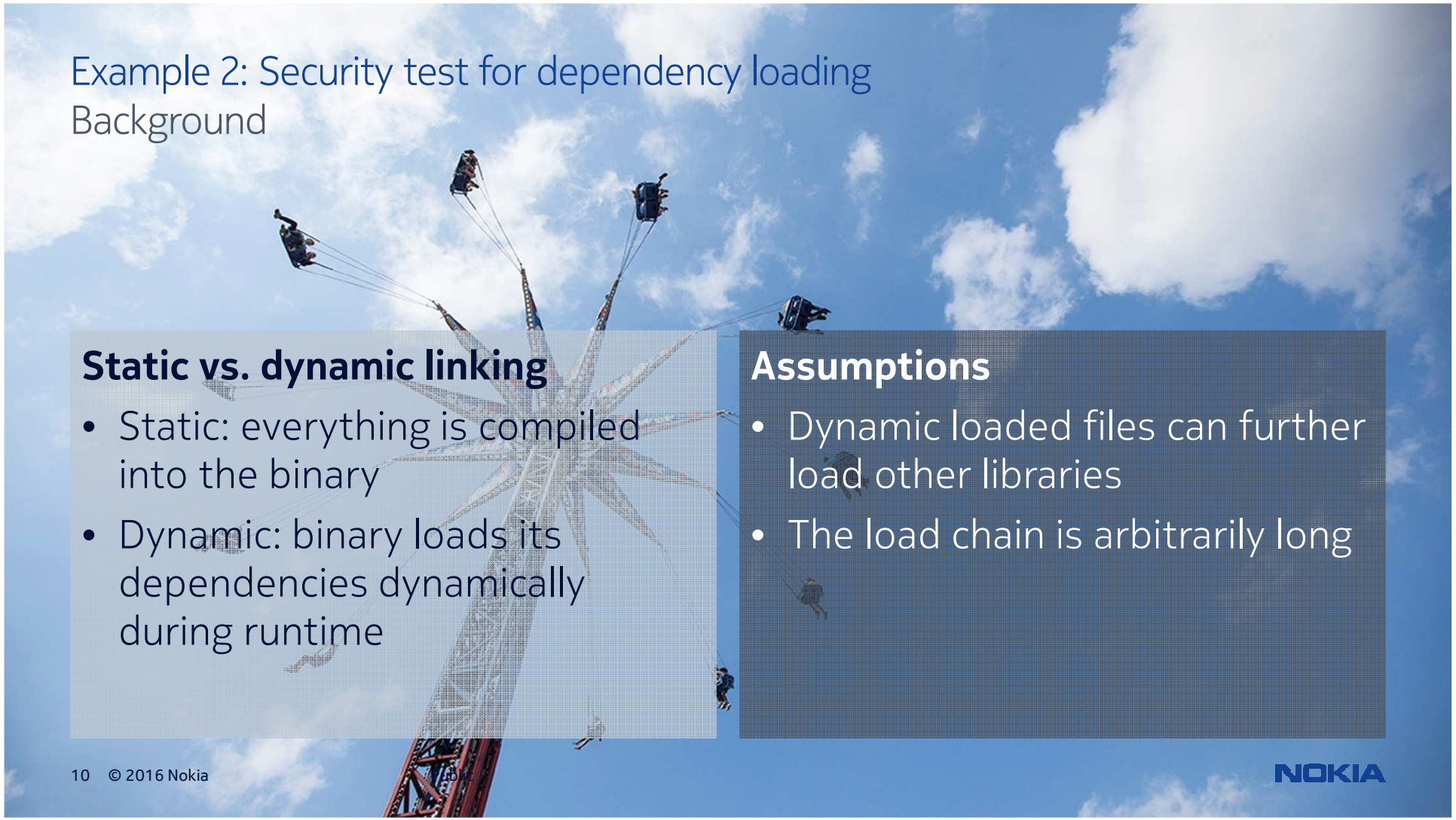
- Nodes:
  - Tag
  - Test case
  - File
  - Repository

- Relationships:

Example 1: Test cases and tags
Simplified example



Example 2: Security test for dependency loading
Background



Static vs. dynamic linking

- Static: everything is compiled into the binary
- Dynamic: binary loads its dependencies dynamically during runtime

Assumptions

- Dynamic loaded files can further load other libraries
- The load chain is arbitrarily long

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Example 2: Security test for dependency loading
Problem statement

Inspired by: https://github.com/quarkslab/binmap

Problem

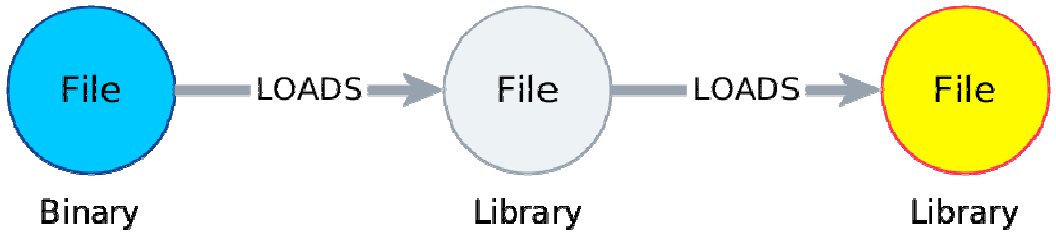
- If there is a vulnerability in one of the OS provided libraries,
- How do we know to what extent our application is affected?

Solution

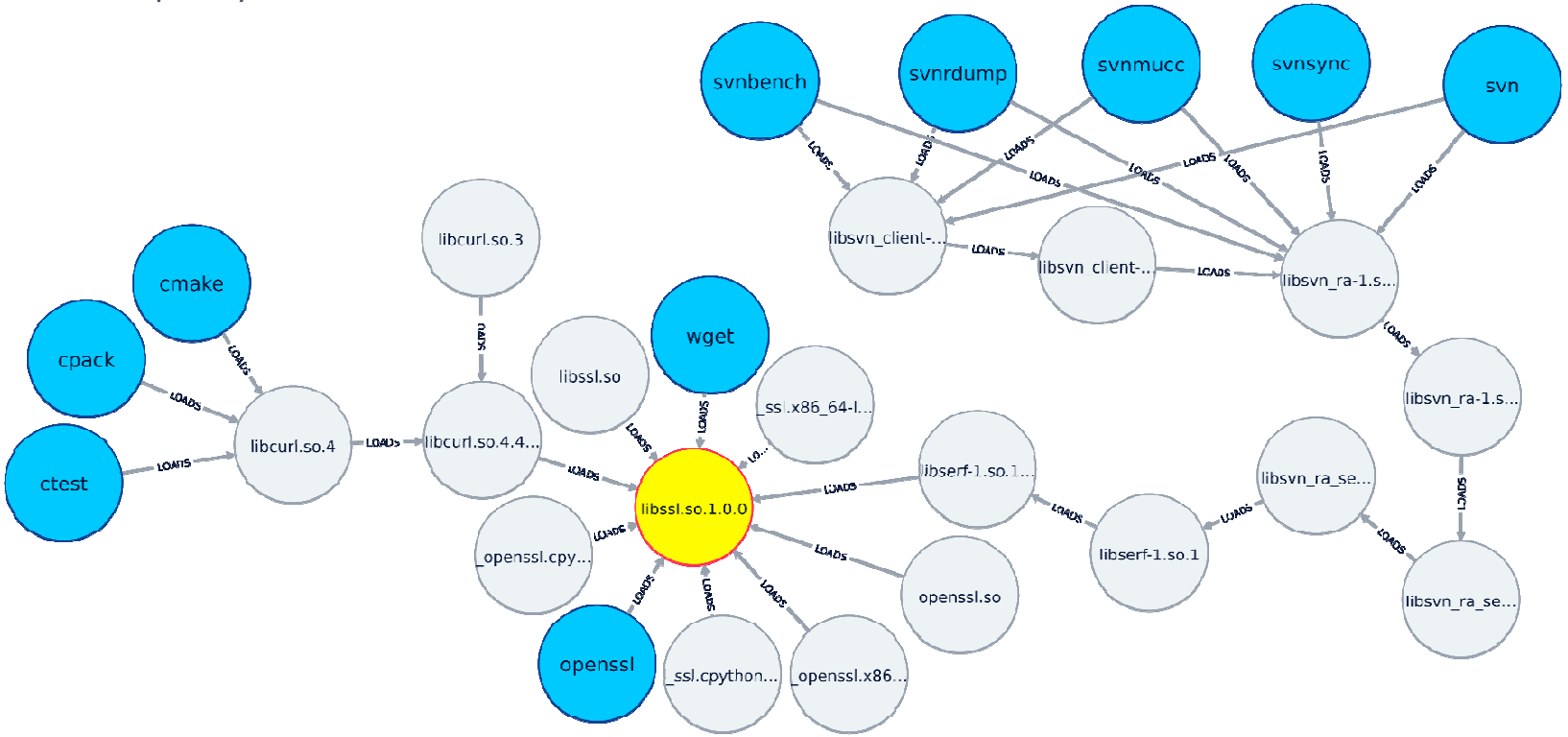
- Use graph DB and search the answer for
  - Who is loading the vulnerable library and function?
  - Is our application loading it via other libraries?

Example 2: Security test for dependency loading
Database model

- Nodes:
  - File: binary and library files
  - Properties: file path
- Edges:
  - Relationship: which file loads which other file
  - Properties: functions loaded



Example 2: Security test for dependency loading
Random query for libssl on Ubuntu



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Some points to consider ...
... based on the examples

Performance

- Measure and compare with traditional RDBMS and different graph DB solutions
- Graph DBs slow down on increasing number of relations / node
- RDBMS slow down on increasing number of nodes

Compatibility

- Graph DBs use proprietary (non-standard) query languages
- There is no standard like SQL for RDBMS
- Swap from one graph DB to the other is not so easy

Conclusion …
… even simpler put

Say **NO** to Graph DB when

- It is faster with traditional RDBMS
- You need complex recursive graph queries to achieve what you want

Say **YES** to Graph DB when

- It is faster with Graph DB
  - No recursion is needed
  - Path traversal faster
- Relations vary in length
- Willingness to learn the specifics of the chosen graph DB solution

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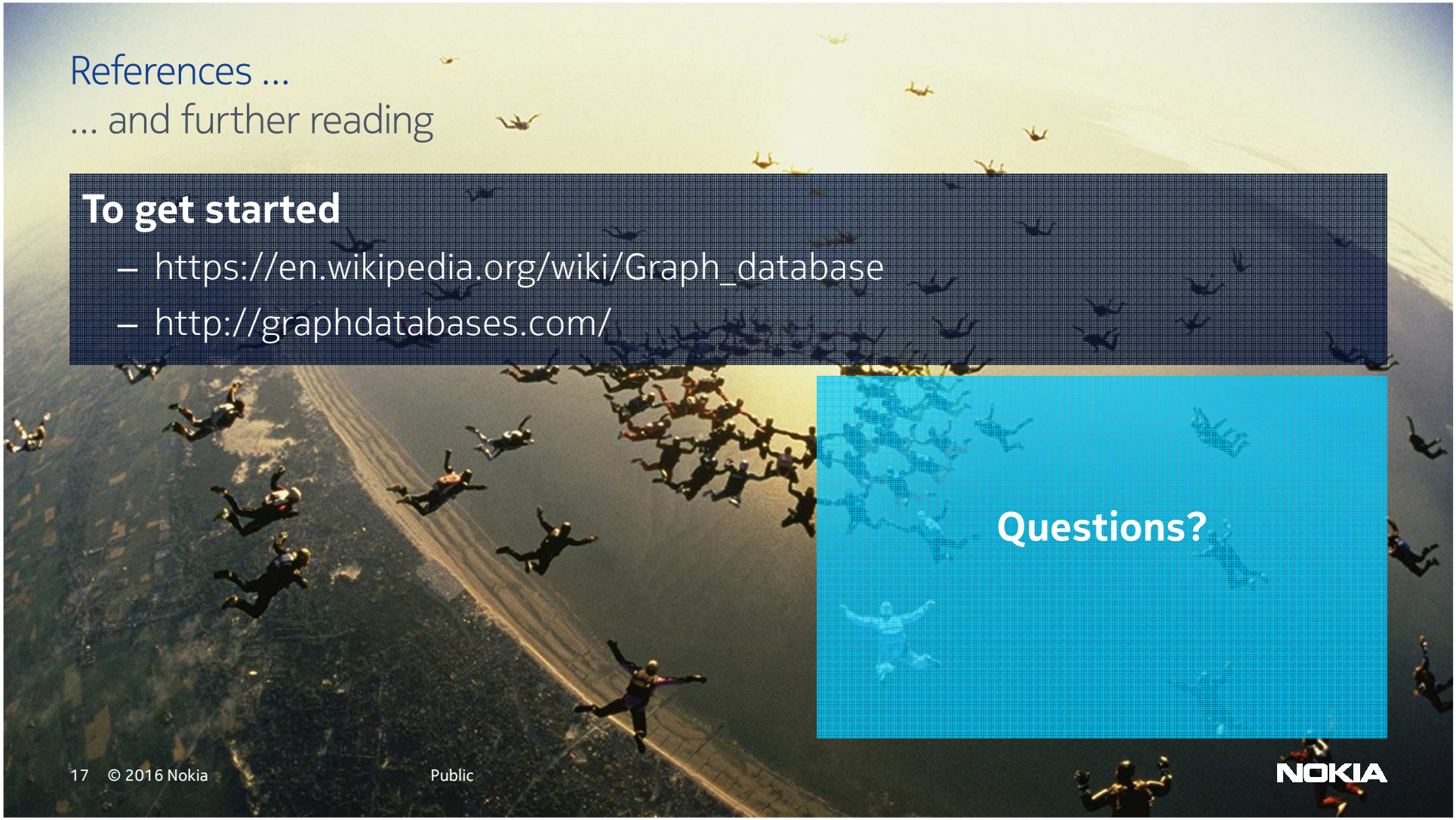
If you want to try ...
... graph database implementations

- Lot of tools (both proprietary and open source) to choose from
- Note: feature sets are overlapping, but different
- Some examples with open source edition:

ArangoDB	Neo4j	OrientDB
https://www.arangodb.com	https://neo4j.com	http://orientdb.com

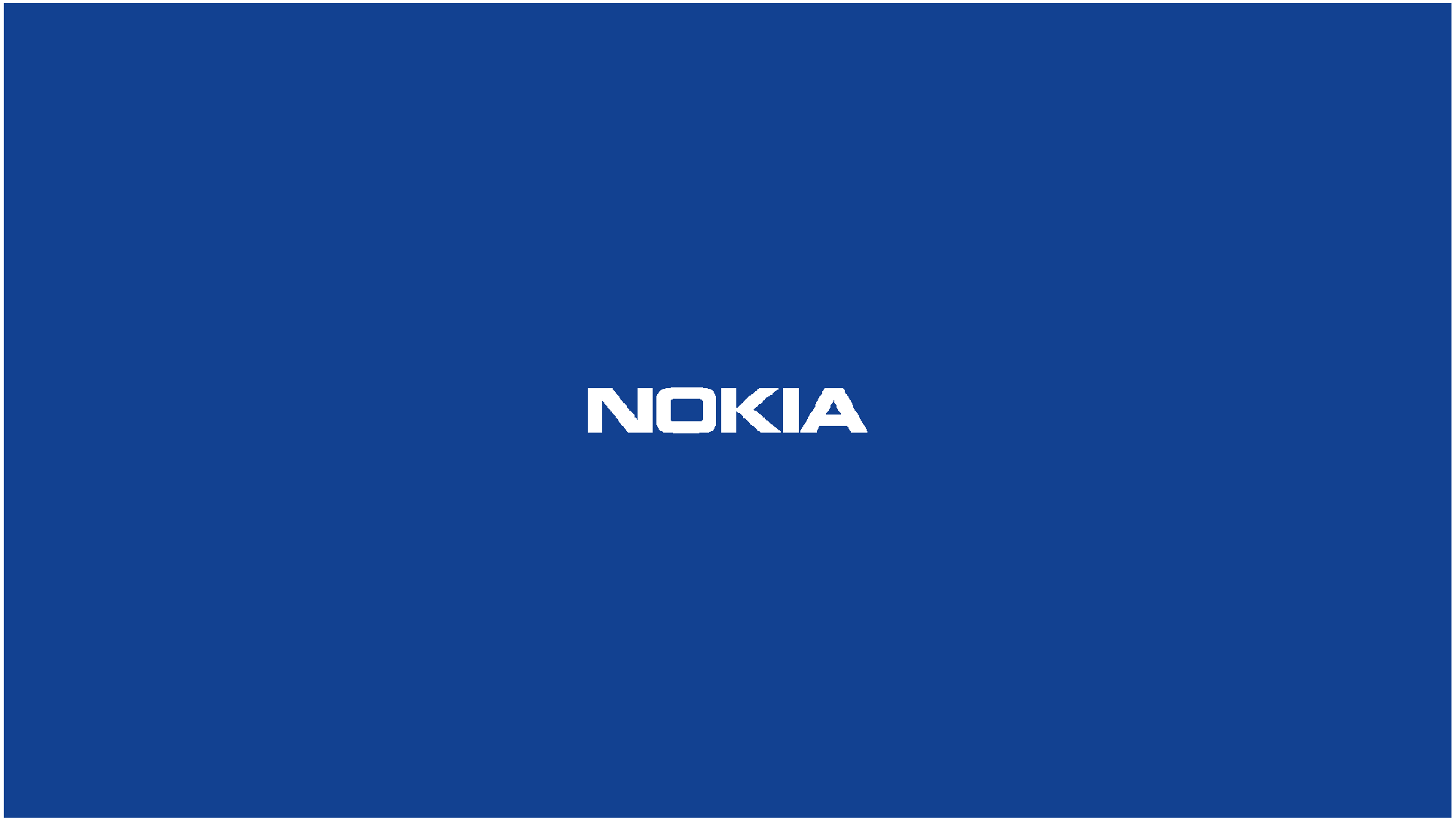


References …
… and further reading

To get started

- https://en.wikipedia.org/wiki/Graph_database
- http://graphdatabases.com/

Questions?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Revision history and metadata

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Version	Description of charges	Date	Author	Owner	Status	Reviewed by	Reviewed date	Approver	Approval date
0.1	First version	2016-09-14	Tóth Attila	Tóth Attila	Verify				
1.0	Review comments applied and approved	2016-09-15	Tóth Attila	Tóth Attila	Approved		2016-09-15	Bujdosó Tibor	2016-09-15

