

INSPECTOR

fast way to find what you need!

 support tool for AIT / AIV phase

TEC-ED & TEC-SW Final Presentation Days
May 8th, 2017
ESA-ESTEC, Noordwijk, The Netherlands

Łukasz Kwieciński (ITTI)

Agenda

- About ITTI
- Motivation
- How does it work?
- What is the content?
- What is the architecture?
- What are the key features?
- How does it technically work?

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ITTI - Company information



- Company mission:
 - development of innovative applications and software solutions
 - applied research in Information & Communication Technologies
 - independent consulting in the area of telecommunications, IT, and business

- Main facts:
 - **SME – ca. 80 persons** with professional certificates, e.g. **PRINCE2, MSP, ITIL, BS 7799/ISO 27001, TOGAF 8/9, Certificate in Software Testing (SJSI/ISTQB), OCUP2**
 - **“Cristal Brussels Prize” 2006, 2010, and 2013** for the most active and successful Polish SME participating in FP6 and FP7
 - Award for the **high performance in R&D projects for EDA**
 - **Membership in international and national bodies:**
 - Polish Space Industry Association (ZPSK)
 - Public Safety Communications Europe (PSCE)
 - Integrated Mission Group for Security (IMG-S)
 - NetWorld2020 (ETP)
 - National and Regional Smart Specialisations (KIS, RIS)

ESA projects (1/2)

■ SpaceWire protocol

- **SPACEMAN** – A SpaceWire Network Management Tool (Sub.: TELETEL, Greece)
- **SpaceR** – Implementation and Validation of the SpaceWire-R Protocol (Sub.: TELETEL, Greece)

■ Space Situational Awareness (SSA)

- **Gaia GOSA** – An interactive service for asteroid follow-up observations (ITTI as subcontractor to OA UAM)
- **P2-NEO-VI** – User Support Tools (Sub.: OA UAM) – under SSA programme
- **NEODECS** – NEO Data Exchange and Collaboration Service (Sub.: OA UAM)
- **NOAS** - NEO&SST Observation Assistant Service (ITTI as subcontractor to OA UAM)
- **SSA PL** – Feasibility study to Setup a Polish Component to SSA (Sub.: OA UAM, CBK Borowiec, CAMK, GMV, PGZ)

ESA projects (2/2)

■ Ground Segment Support Software

- **HMI** – The technology framework for the development of modular, portable and adaptive Human-Machine Interfaces in ground segment software products (*Sub.: VITROCISSET, Belgium*)
- **INSPECTOR** – INtegrated SPacE Components Test platfORM
- **ATENA** – Adjusting open Test Exchange staNdard to the spAce domain (*Sub.: VITROCISSET, Belgium*)

■ Other (e.g. feasibility studies)

- **LEX EO** - Law Enforcement eXploitation of Earth Observation – under EOEP programme (*ITTI sub. to e-Geos*)
- **DART – Direct Air Transport** – under ARTES 20 programme (*Subcontractors: Institute of Avionics, Polish Aeroclub, Mlabs*)
- **EO SEED** – Support to Enhanced EO Activity in Priority States (*ITTI sub. to OGK*)
- **PPSLI** – Participation of Poland in the ESA Small Launcher Initiative (*ITTI sub. to Polish Armaments Group*)

Publications

- **International SpaceWire Conference** (September 2014) – *SPACEMAN: A SpaceWire Network Management Tool, Space-R: Spacewire-R*
- **SESP** (March 2015) – *ESA-HMI Standardized framework for designing Human-Machine Interfaces*
- **DASIA** (May 2016) – *INSPECTOR – Supporting tool for AIT/AIV phase*
- **International SpaceWire Conference** (October 2016) – *SpaceWire Network Management Using Network Discovery and Configuration Protocol*
- **SESP** (March 2017) – *ATENA – adjusting open test exchange standard to the space domain*
- Contributions to **SpaceWire Working Group** (since 2014)
- Several presentations at **national conferences**

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Motivation

- A great amount of documentation in AIT / AIV phase causes information overload syndrome:

*I'm sure that I have seen a document,
but I cannot find it when I need it*

- It leads to waste of time and unnecessary repetition of work
- ...when problems are solved several times due to unawareness **that solution is already found.**



The idea

- The common access to **mobile devices**



- ...which can be used as **pocket database**

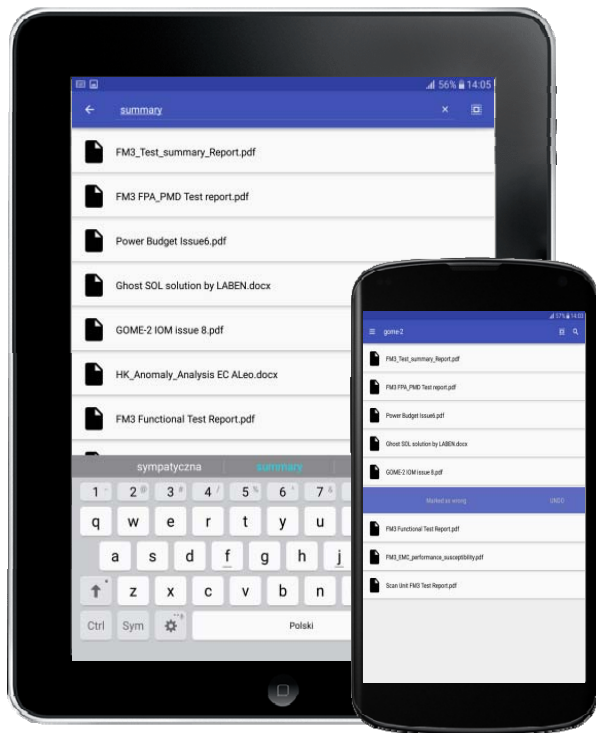


- ...even in **off-line mode**



The solution

- The solution is a distributed system called **INSPECTOR**:

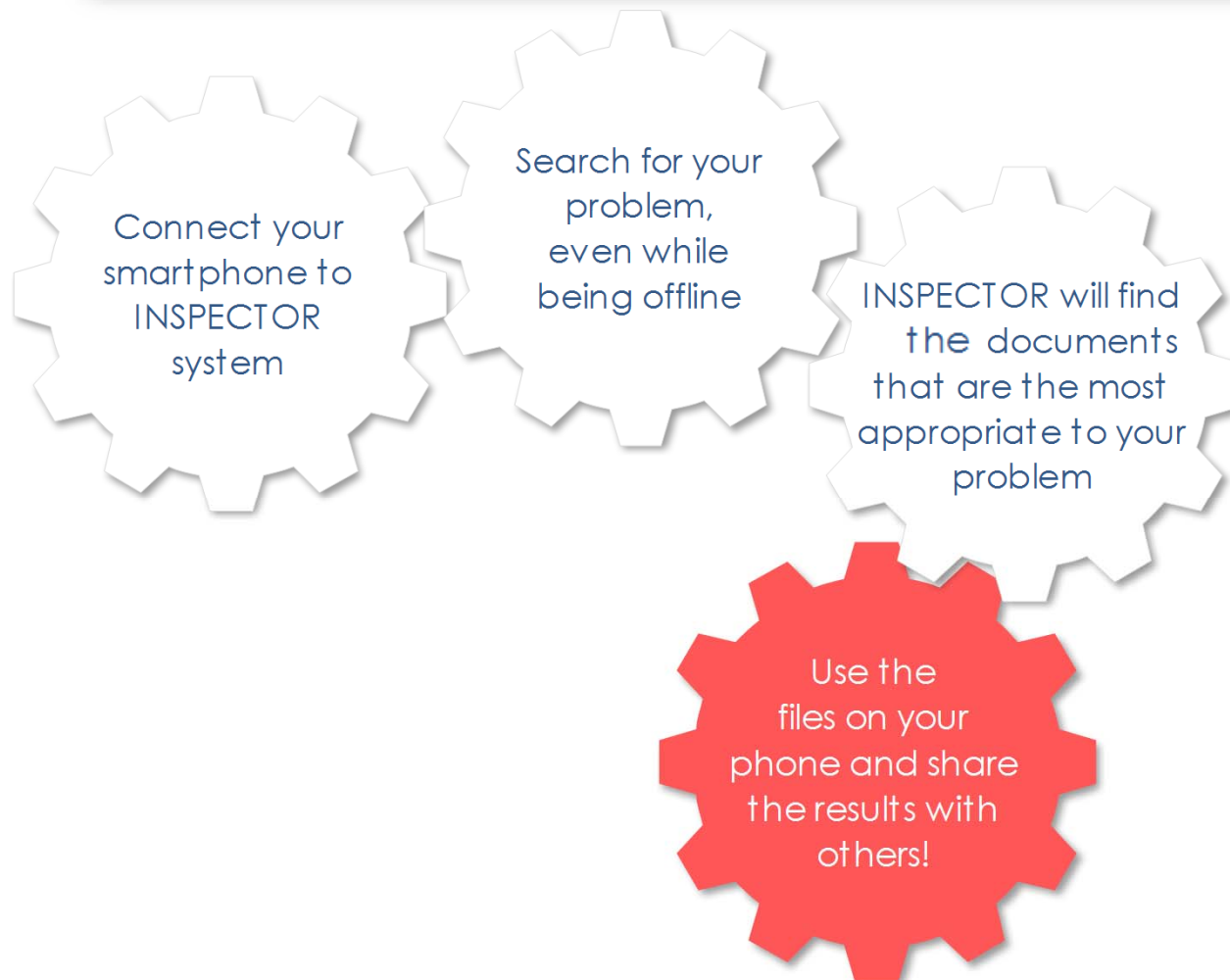


- ... that allows efficient search in **large collections of documents**
- ... and provides access to documents databases **off-line**, i.e. without Internet/intranet access
- ... for personnel performing complex operations (e.g. construction, machine assembly or integration, etc.) **in field**, not in bureau
- ... also with **group work** capabilities.

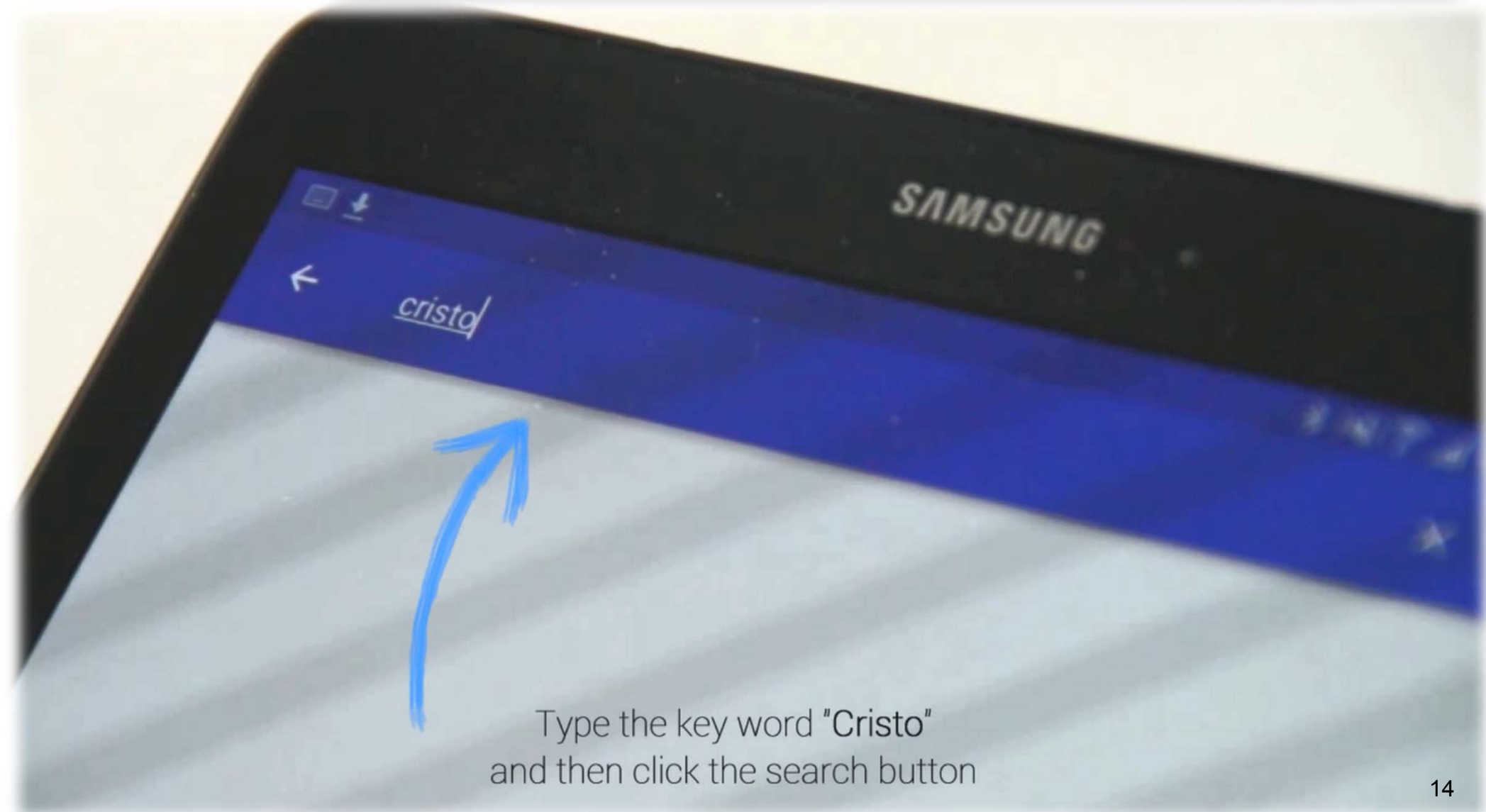
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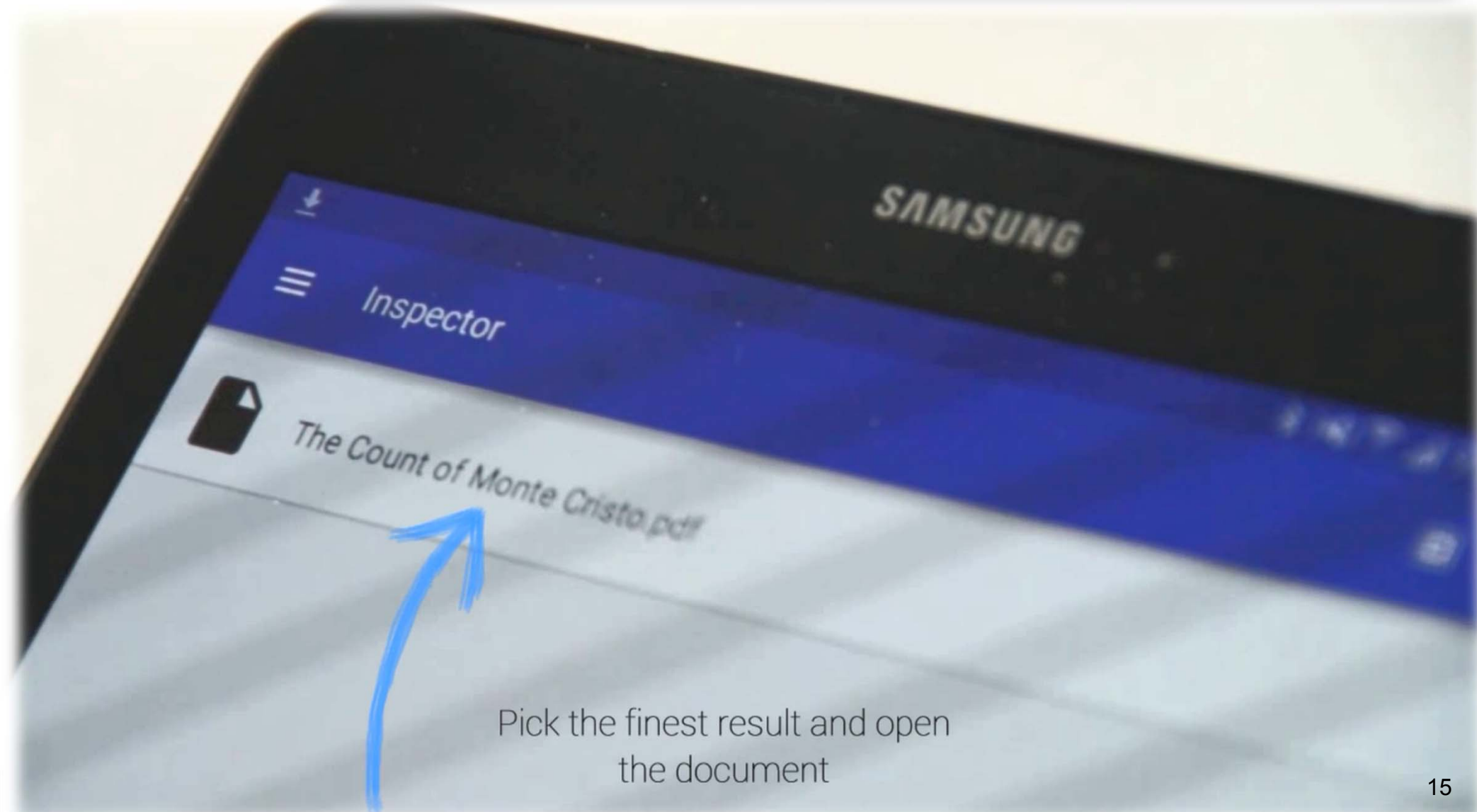
How does it work?



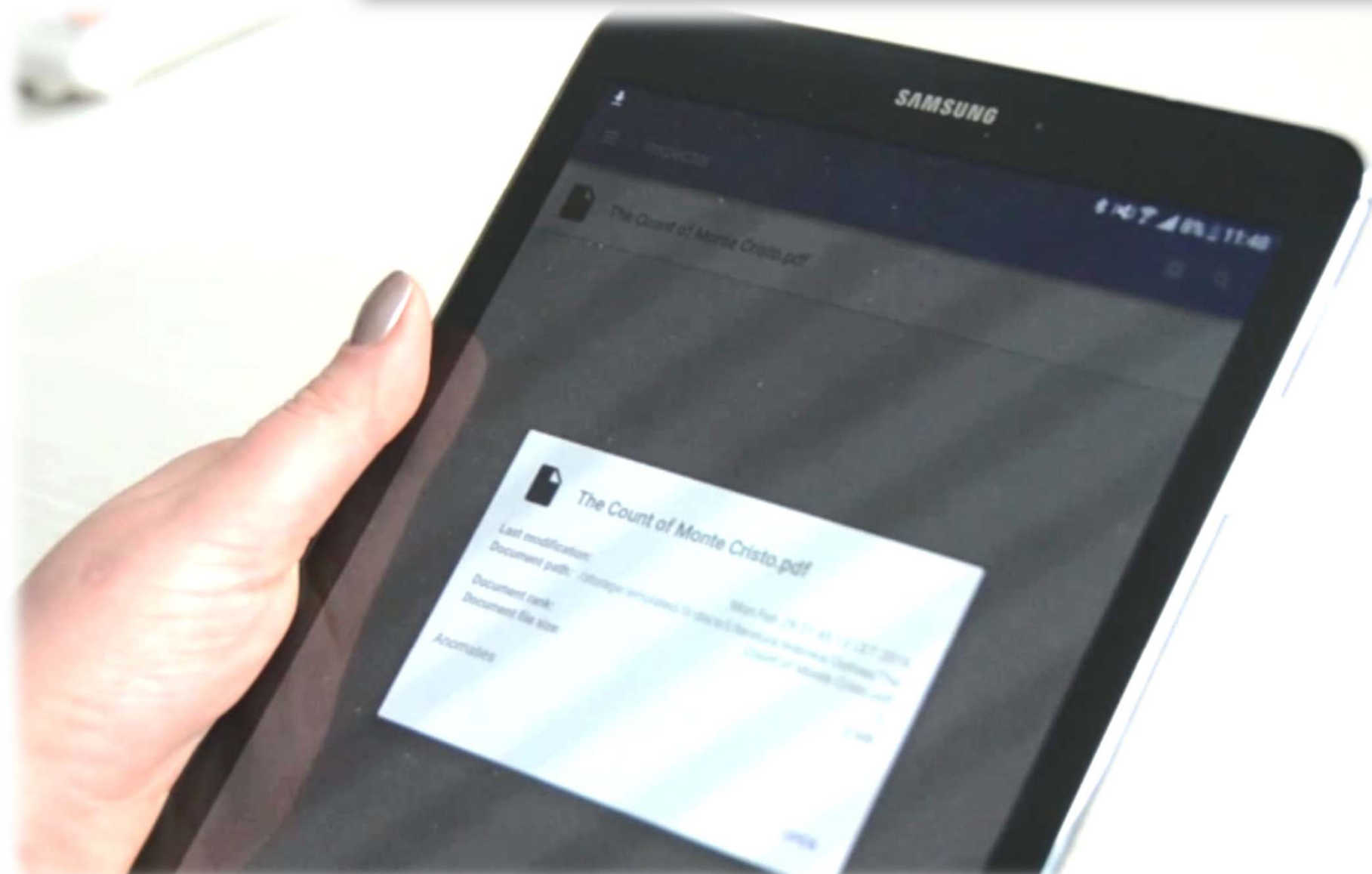
Basic scenario: Step 1



Basic scenario: Step 2



Basic scenario: Step 3



Basic scenario: Step 4

The Count of Monte Cristo

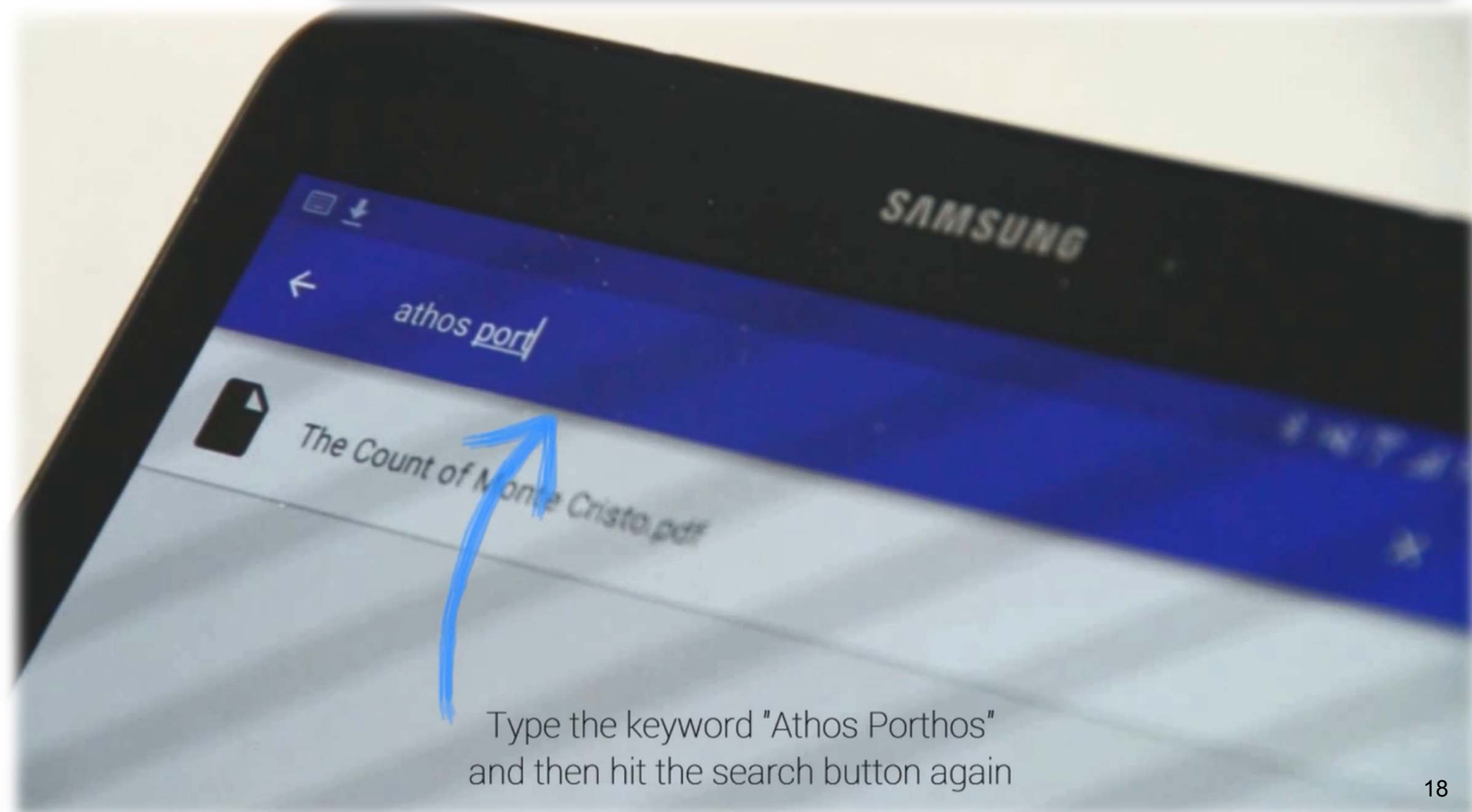
By

Alexandre Dumas pere



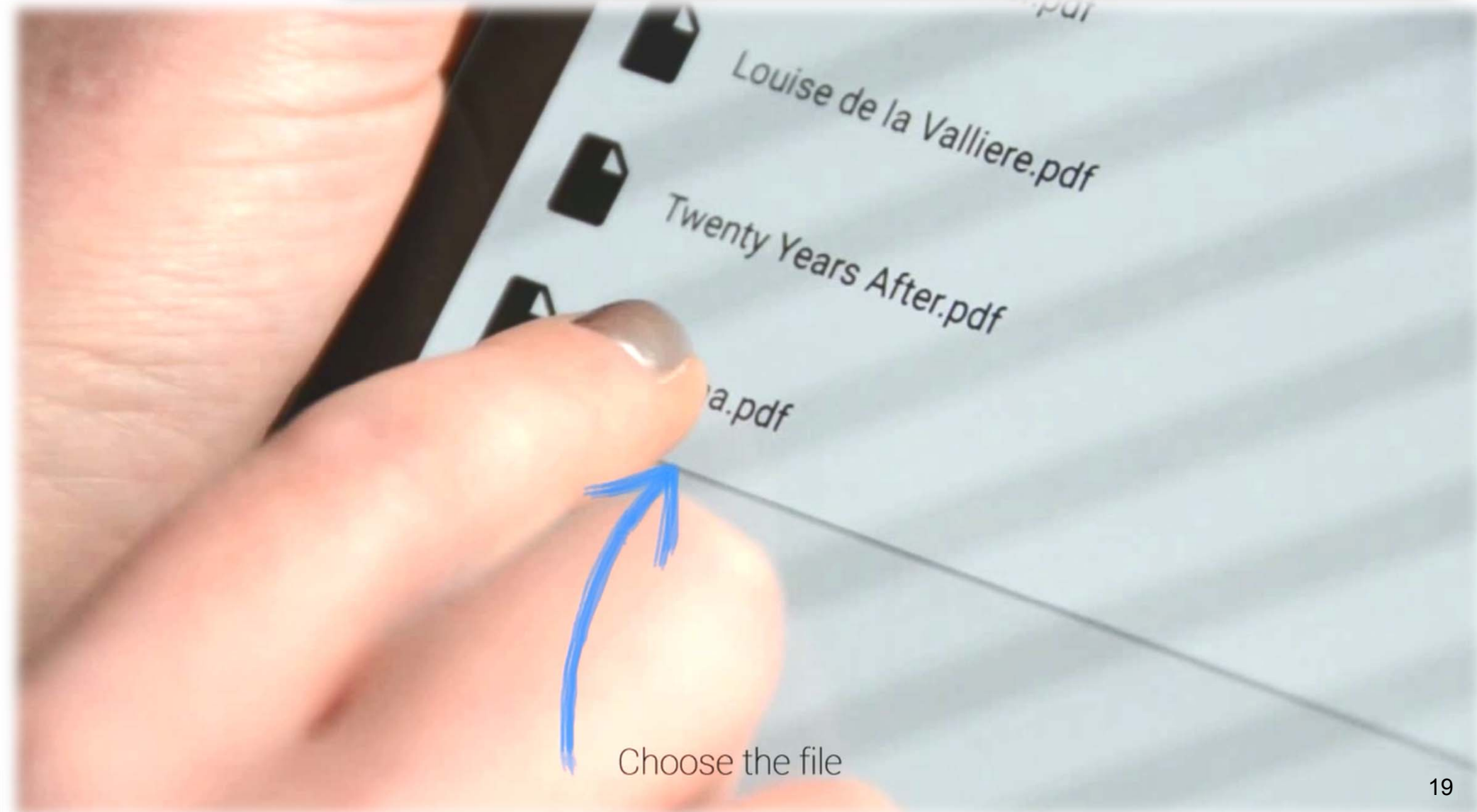
The document will display on
your screen immediately

Basic scenario: Step 5

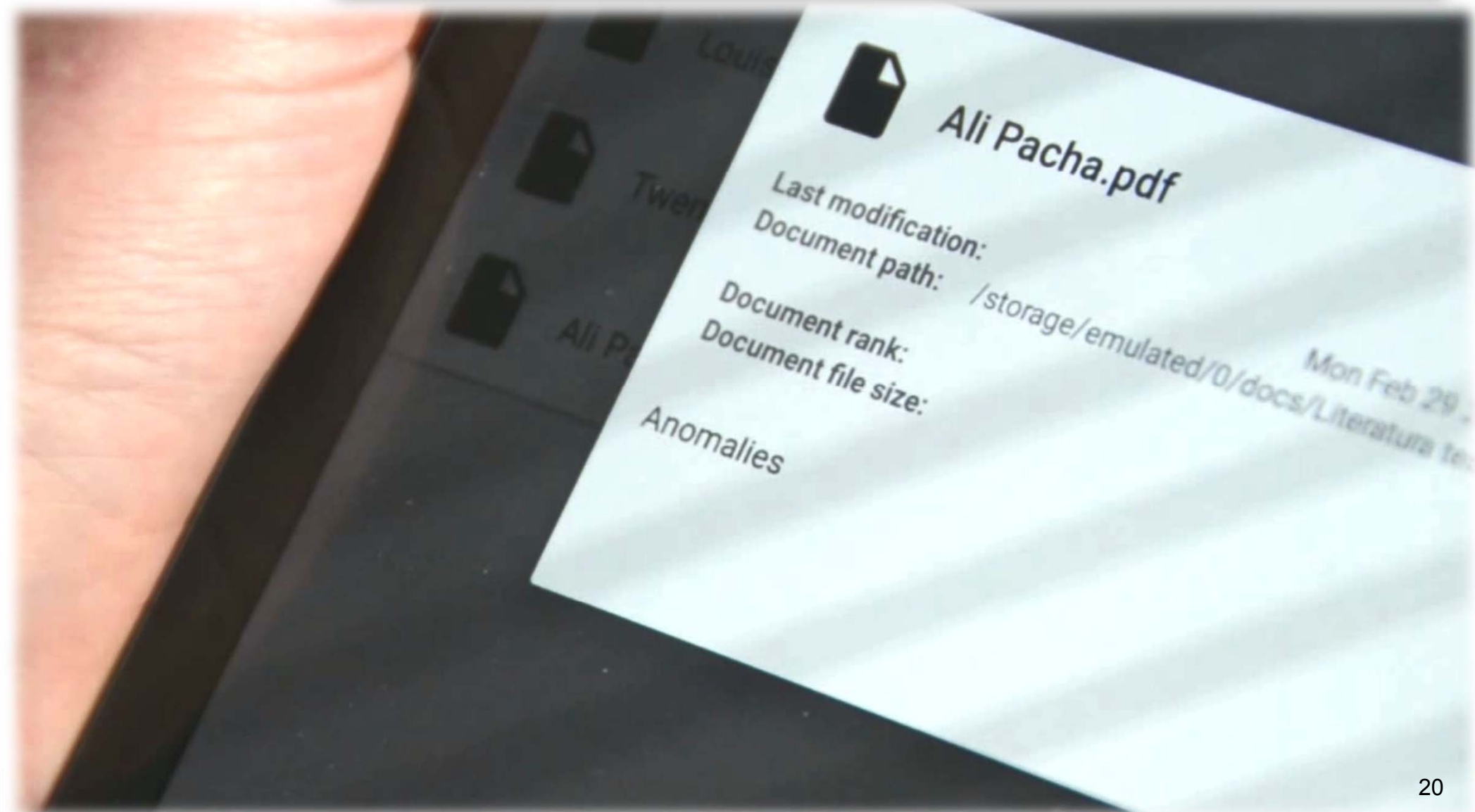


Type the keyword "Athos Porthos"
and then hit the search button again

Basic scenario: Step 6



Basic scenario: Step 7



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Documents



- Documentation related to the mission
- Test reports
- User Manuals
- Standards, etc.

- Imported from defined sources: **Alfresco** (WebDAV), **FTP**
- **Uploaded manually** via HMI

Lessons learnt



- Best practices identified in AIT / AIV phase
- Specification of problem solutions
- Short textual notes that may be attached to other data
- **Created manually** via HMI

Anomalies



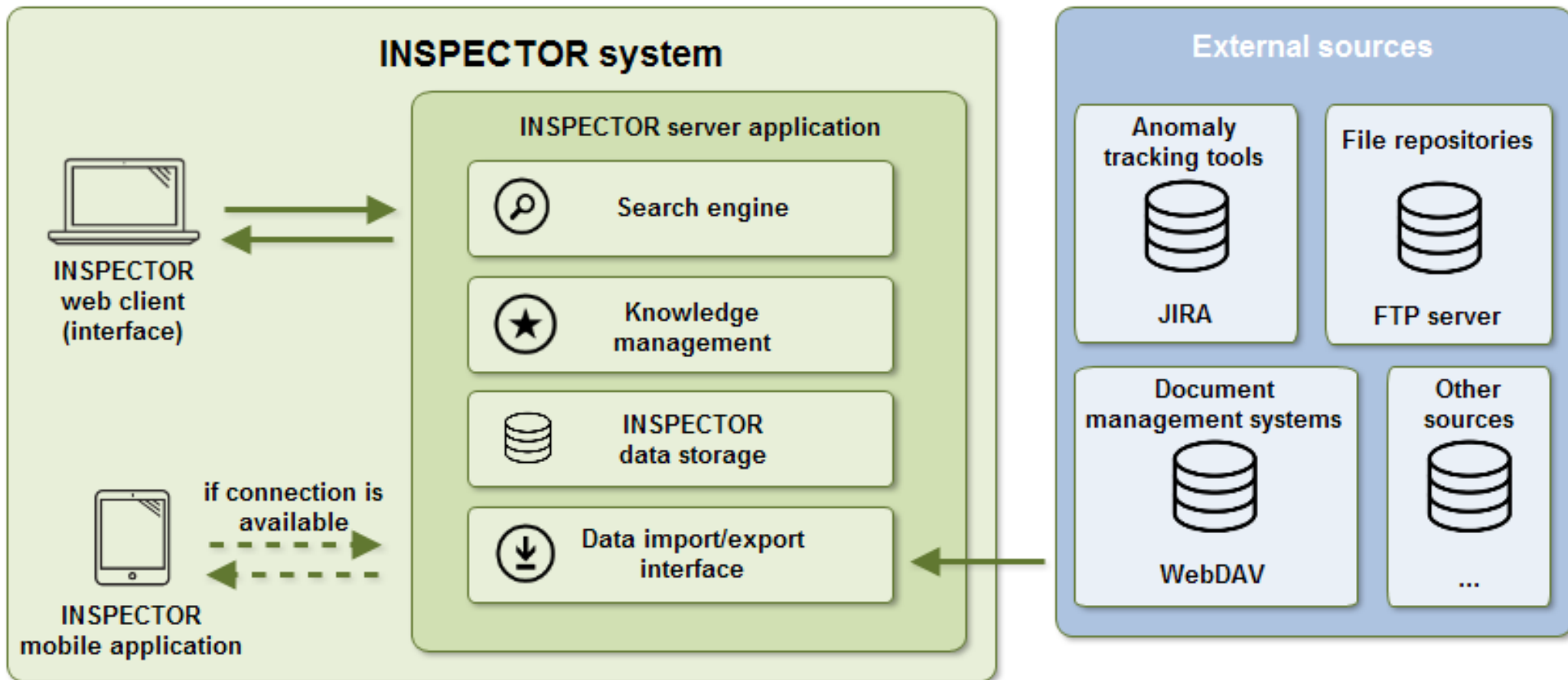
- Typical problems identified in AIT / AIV phase
- Reported system bugs, errors, failures

- Imported from defined sources: **JIRA**
- **Created manually** via HMI

Agenda

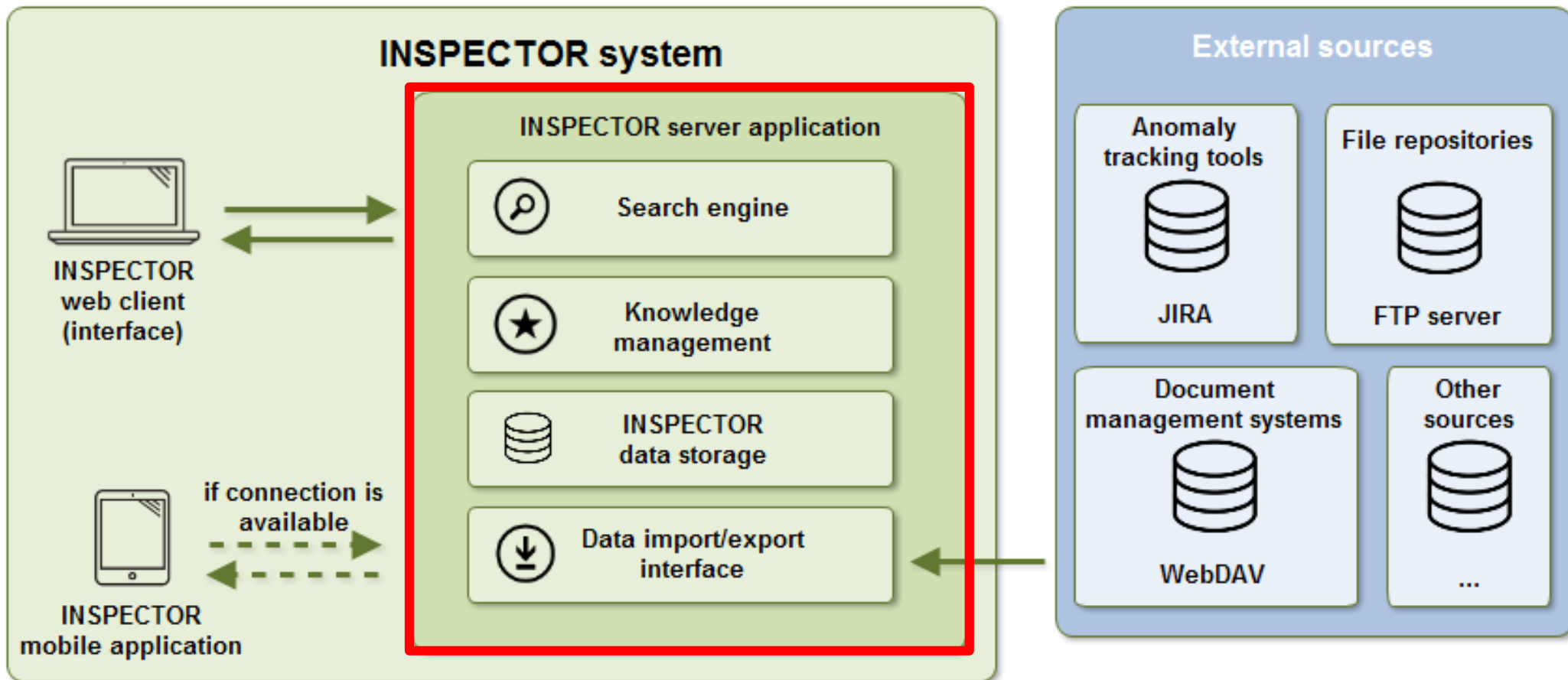
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Main components



INSPECTOR

Server application



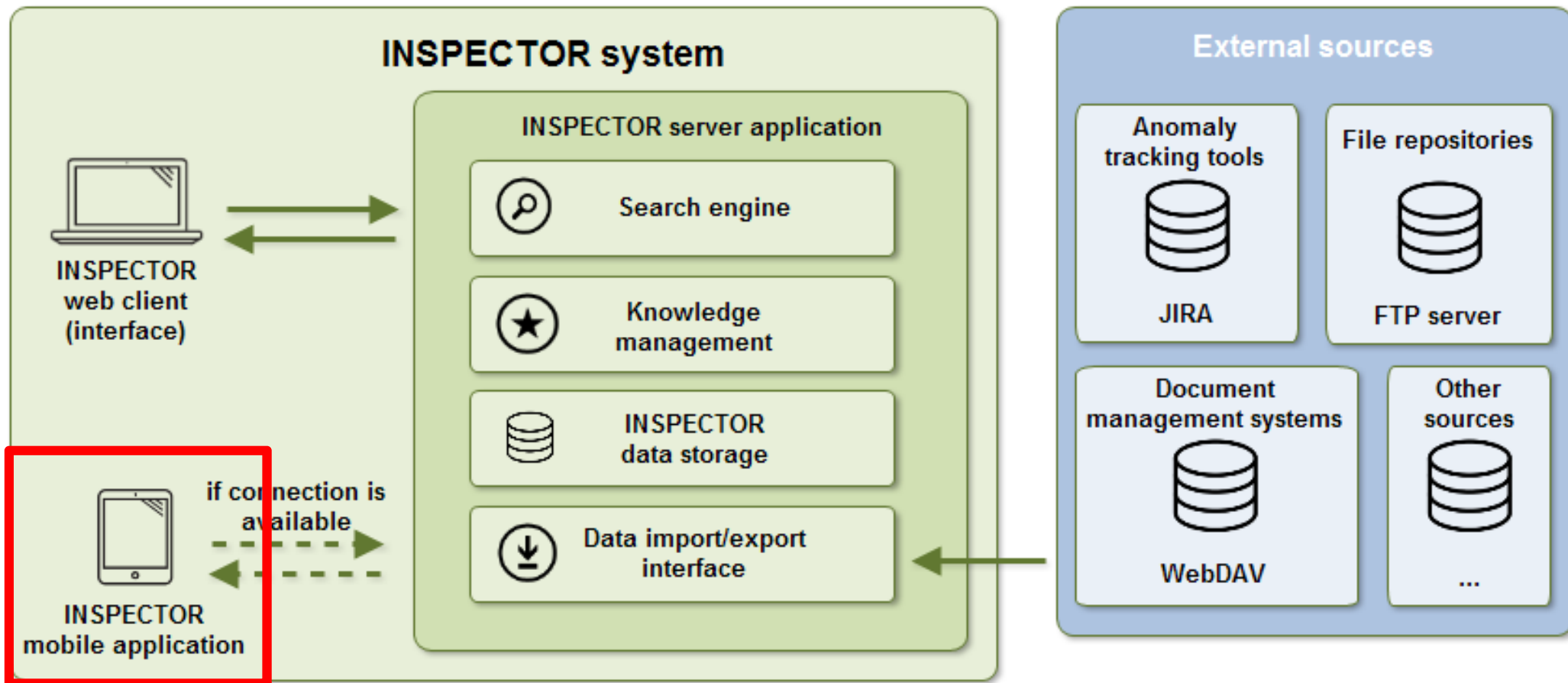
INSPECTOR

Server application

- The main database of the INSPECTOR,
- Gateway for ESA documents repositories,
- OCR engine (for scanned documents),
- Auto-learning engine (based on history of usage),
- Central synchronization point for mobile devices.

INSPECTOR

Mobile application



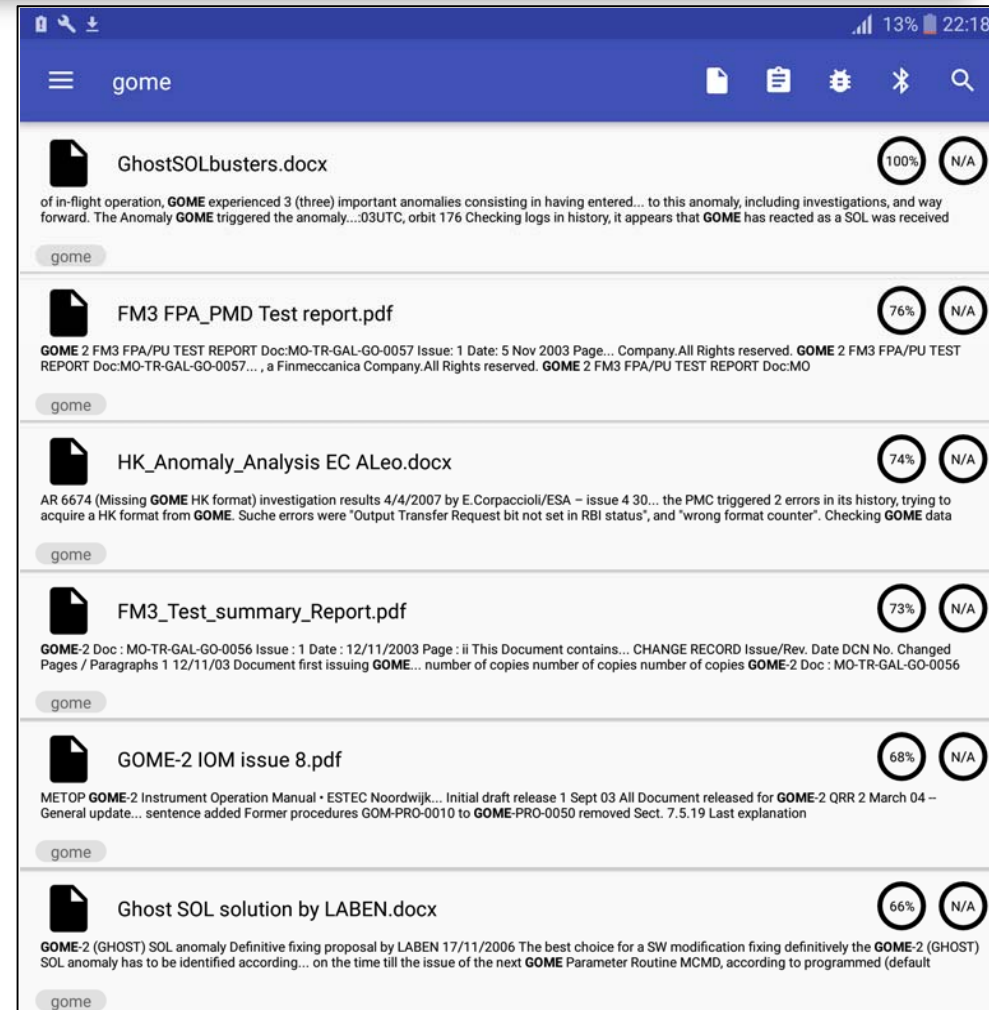
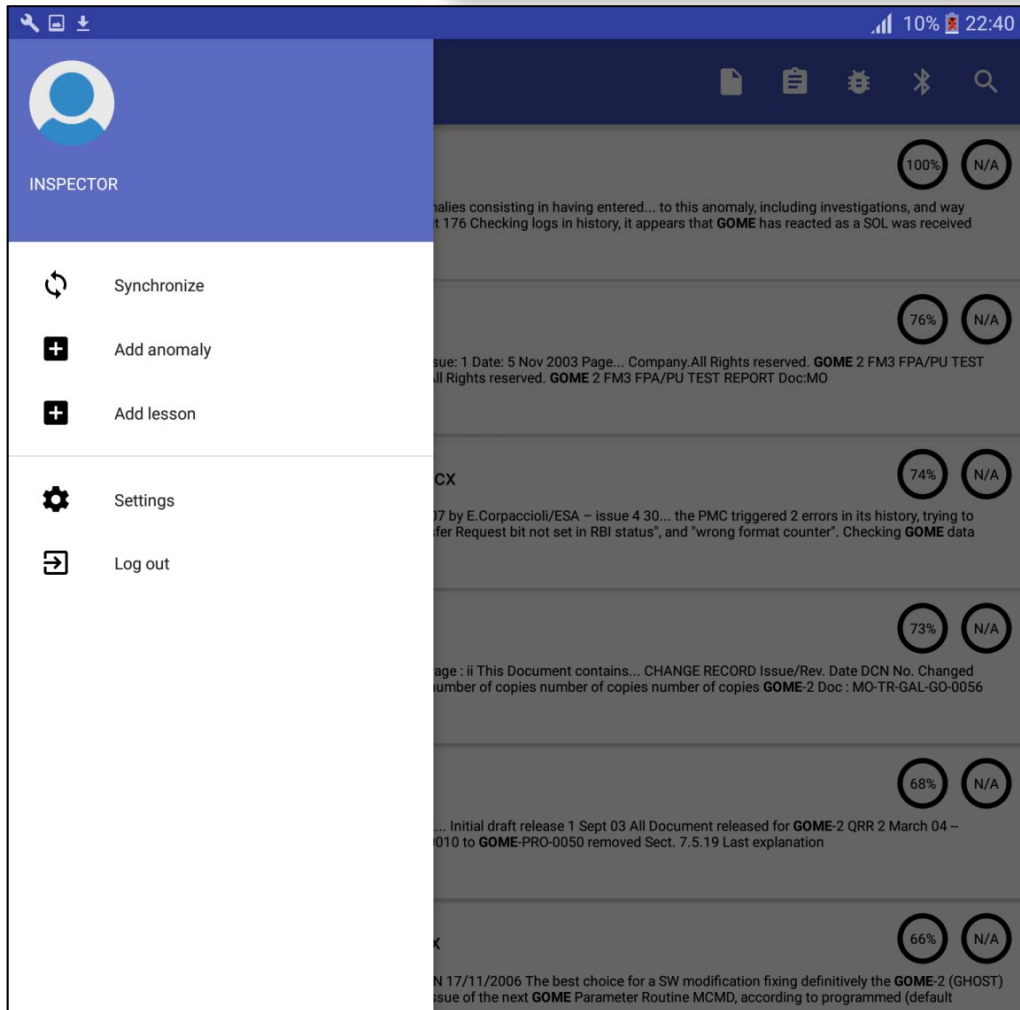
INSPECTOR

Mobile application

- APK for Android devices (Android 5 or higher is required),
- Technically it is an off-line replica of server database,
- Synchronization is automatic when connected to network.

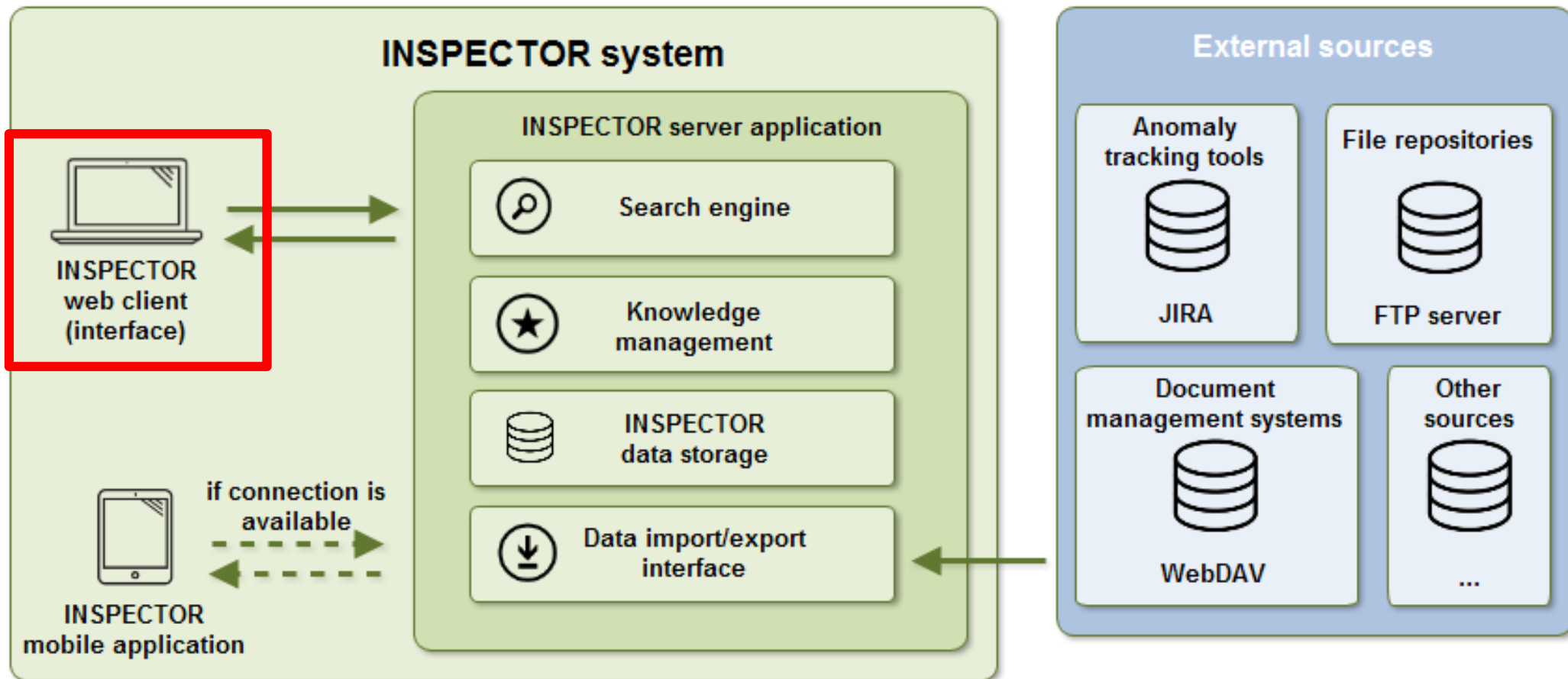
- Basic functionalities:
 - Displaying sorted list of results related to the query,
 - Displaying metadata of results,
 - Displaying the content of results (external viewers),
 - "Wrong document" - user feedback,
 - Ability to add anomalies,
 - Ability to add lessons learnt,
 - Direct device-to-device data transfer by Bluetooth.

INSPECTOR Mobile application



INSPECTOR

Web client



INSPECTOR Web client

- User (web) interface for the INSPECTOR server,
- Technically it is a thin-client,
- Provides all functionalities of mobile application,
- ... and in addition:
 - ability to manually tune data object appropriateness for particular search queries,
 - ability to upload and manage documents,
 - ability to edit and delete anomalies,
 - ability to edit and delete lessons learnt,
 - ability to manage the data relations.

INSPECTOR Web client

INSPECTOR Battery_Datasheet.pdf

v1.0 (2016-12-1)

user manual

ADD DOCUMENT ADD ANOMALY ADD LESSON

| Document Name | manual | user | 100% | 0% |
|---|--------|------|------|----|
| 1.5U_EPS_User_Manual.pdf | manual | user | 100% | 0% |
| 685.pdf | manual | user | 100% | 0% |
| 686.pdf | manual | user | 100% | 0% |
| Battery_Datasheet.pdf | manual | user | 100% | 0% |
| CS-SBAT2-30_User_Manual.pdf | manual | user | 100% | 0% |
| CubeSat_1U_Electronic_Power_System_and_B... | manual | user | 100% | 0% |
| FleXible_Electronic_Power_System_CS-XUEP... | manual | user | 100% | 0% |
| GOME-2_IOM_issue_8.pdf | manual | user | 100% | 0% |
| PDM_USM.pdf | manual | user | 100% | 0% |

Battery_Datasheet.pdf

Description:

Tags: esa user test manual

Last modified: 05/05/2017, 15:53:27

Created: 04/23/2017, 09:18:13

[OPEN](#) [READ MORE](#) [MARK AS UNWANTED](#)

INSPECTOR Web client

INSPECTOR Battery_Datasheet.pdf


v1.0 (2016-12-1)


user manual

ADD DOCUMENT ADD ANOMALY ADD LESSON

Battery_Datasheet.pdf


OPEN MARK AS UNWANTED DELETE


Description: 

Tags: manual esa test user 


Last modified: 04/23/2017, 09:18:07

Created: 04/23/2017, 09:18:13

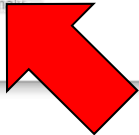
Related anomalies (1) 

Related lessons (0) 

Recommended documents (1)

 STX_UM_V_1.7.pdf

Test anomaly



INSPECTOR Web client

INSPECTOR v1.0 (2016-12-1)

Battery_Datasheet.pdf STX_UM_V_1.7.pdf

user manual

ADD DOCUMENT ADD ANOMALY ADD LESSON

STX_UM_V_1.7.pdf

OPEN MARK AS UNWANTED DELETE

Description:

Tags: manual test user

Last modified: 04/23/2017, 09:18:07


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Related anomalies (1)

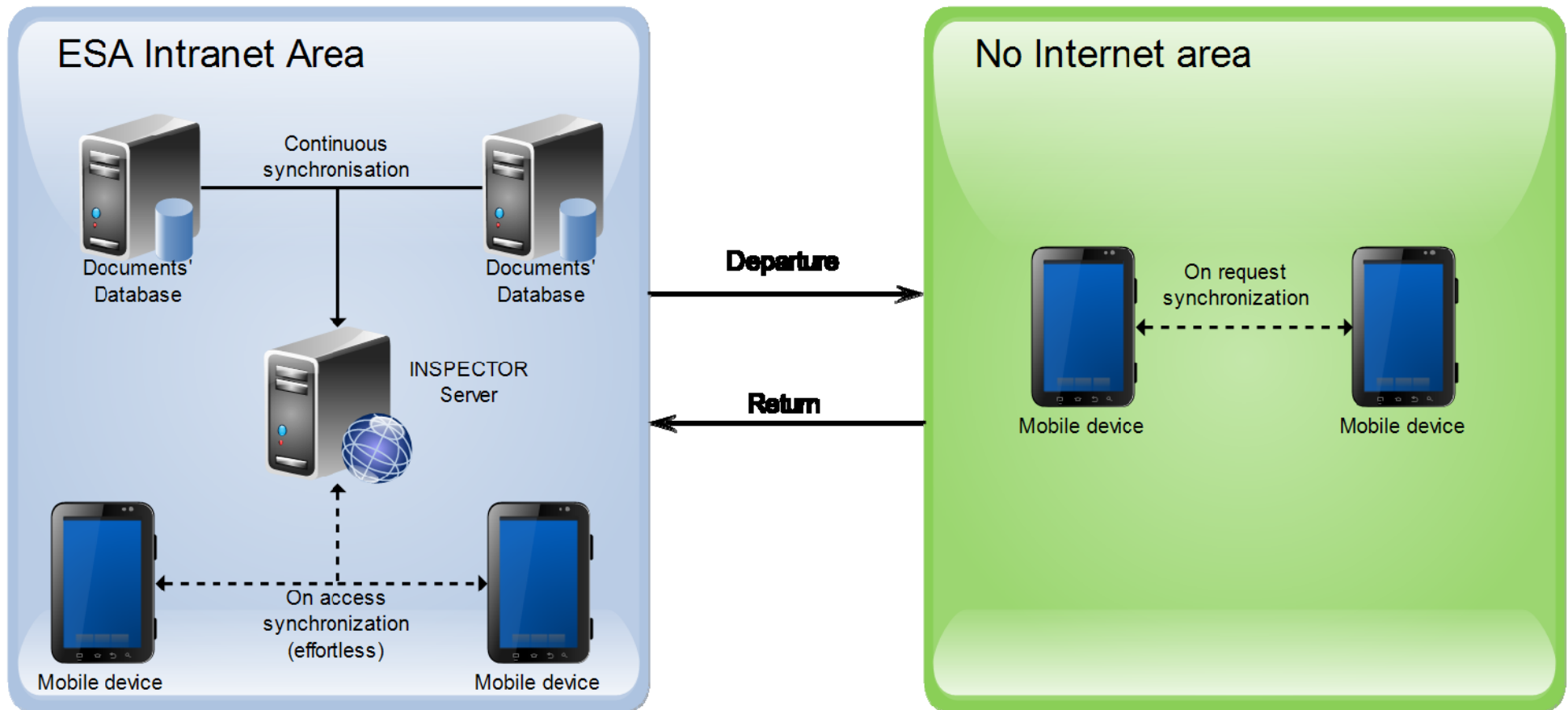
Related lessons (0)

Recommended documents (1)

Battery_Datasheet.pdf
Test anomaly



The principle of work

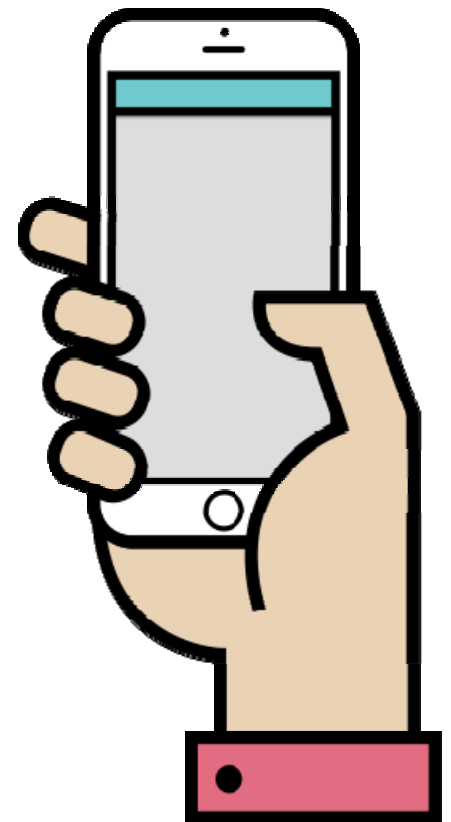


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Always ready

- INSPECTOR requires no mission preparation activities,
- users must only remember to take smartphones or tablets to a mission,
- manual mission preparation is possible, but optional.



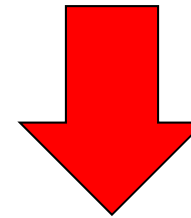
Preparation and operational phases support

- System can be used for **preparation phase** on web browser

Add new tag

gome

ADD CLOSE



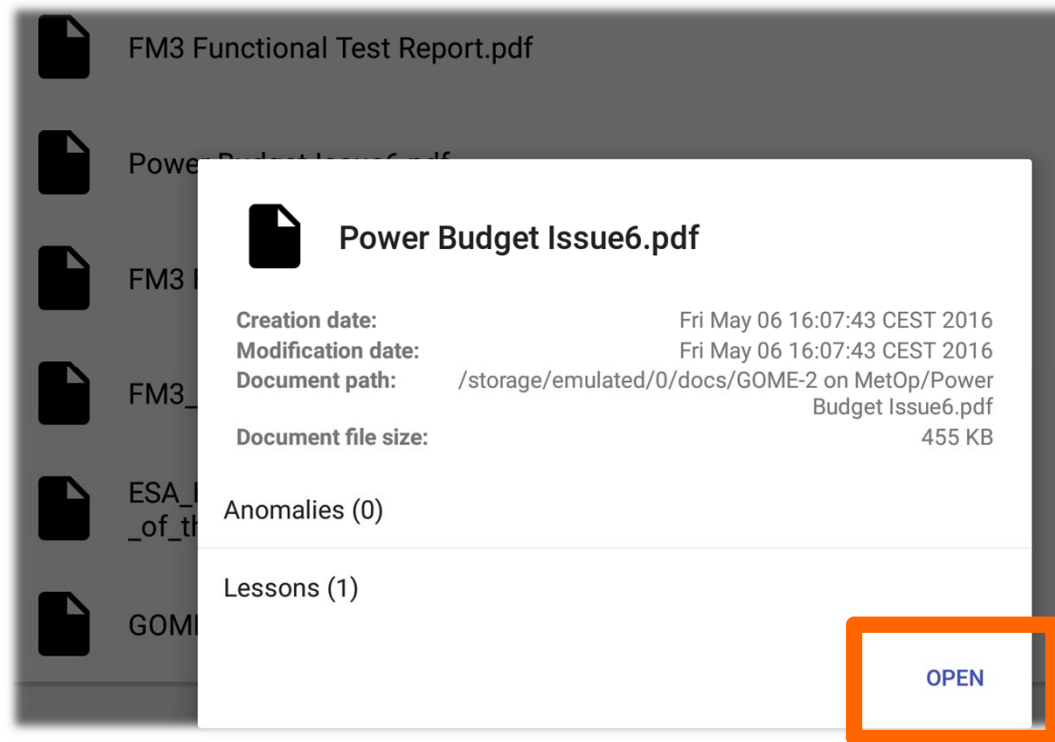
- ...and on the mobile application dedicated for **operational use**.

The screenshot shows a mobile application interface with a blue header bar containing the text 'gome' and various icons. Below the header, there is a list of documents, each with a file icon, a title, a progress indicator (a circle with a percentage), and a status indicator (a circle with 'N/A'). The documents listed are:

- GhostSOLbusters.docx**: 100% progress, N/A status. Description: of in-flight operation, GOME experienced 3 (three) important anomalies consisting in having entered... to this anomaly, including investigations, and way forward. The Anomaly GOME triggered the anomaly...03UTC, orbit 176 Checking logs in history, it appears that GOME has reacted as a SOL was received.
- FM3 FPA_PMD Test report.pdf**: 76% progress, N/A status. Description: GOME 2 FM3 FPA/PU TEST REPORT Doc:MO-TR-GAL-GO-0057 Issue: 1 Date: 5 Nov 2003 Page... Company.All Rights reserved. GOME 2 FM3 FPA/PU TEST REPORT Doc:MO-TR-GAL-GO-0057..., a Finmeccanica Company.All Rights reserved. GOME 2 FM3 FPA/PU TEST REPORT Doc:MO
- HK_Anomaly_Analysis EC ALeo.docx**: 74% progress, N/A status. Description: AR 6674 (Missing GOME HK format) investigation results 4/4/2007 by E.Corpaccioli/ESA - issue 4 30... the PMC triggered 2 errors in its history, trying to acquire a HK format from GOME. Such errors were "Output Transfer Request bit not set in RBI status", and "wrong format counter". Checking GOME data

All knowledge in a pocket

- Full read access to enterprises' documentation databases
- ...with no Internet connection



Effortless operations

- INSPECTOR requires neither maintenance nor configuration activities from its users:
 - **automatic resynchronization**
after regain Internet connection
 - **automatic documents' assessment**
without manual tagging
 - **autolearning**
based on crowdsourcing approach

Support of various file types

- System supports the most common types of files



Local device-to-device sharing

- Local device-to-device knowledge and documents sharing inside a group of personnel working together.




Advanced search engine

- User is allowed to search a content of documents against patterns, that is chains of letters (keywords) possibly separated by Boolean logic operators: **AND**, **OR**, **NOT**.

esa /test !manual



 Ghost_SOL_solution_by_LABEN.docx

esa test

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 FM3_FPA_PMD_Test_report.pdf

esa test

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Knowledge database auto-building

- Automatic dissemination of problems encountered and solutions found among the users.
- Rankings and dependencies between problems and their solutions are based on user actions made while searching concrete problem solutions.

Agenda

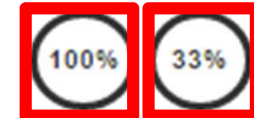
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Results ranking

 FM3_FPA_PMD_Test_report.pdf

esa

test



- The elements of the search results list are described by:
 - appropriateness of the content to the search query,
 - the number of selections of the element for similar queries in the past,
 - direct user's feedback by "*wrong document*" option (document is moved to the bottom of the list)
- The more users were interested in particular document in similar context in the past, the higher the document will be presented on the results list.

Results ranking

- The appropriateness of a document/lesson/anomaly i to the searched query Q is computed as follows:

$$a(i, Q) = \sum_{q \in Q} \sum_{t \in T} (s(q, t) \cdot o(i, t))$$

- where:
 - Q – whole entered query, q – a single word in a query,
 - T – the set of all tags (single words) stored in knowledge DB, t – single tag (word)
 - I – the set of all items (documents or lessons or anomalies) in the database, i – the single item,
 - $s(q, t) \rightarrow \{0, 1\}$ – the similarity function (between two words q and t) of Boolean type.
 - $o(i, t) \rightarrow \mathbb{N}$ – the number of opens of the item i for t word included in a query in the past

Results ordering

- The results list contains all items (documents, lessons or anomalies) that have at least one keyword shared with the query entered.
- The items are sorted in using the following criteria:
 - Firstly, the items are sorted in order of the number of keywords shared with the query entered,
 - Secondly, the classes of items that shares the same number of keywords with the search query are sorted in order of their appropriateness.

Wrong document mark

- The algorithm of identifying wrong documents within queries:
 - The keywords in the entered query are sorted in the alphabetic order,
 - ... which ensures that queries are immune to grammar – in fact query is a „set of keywords” in mathematical sense
 - ...and the number of queries to store is significantly reduced
 - If for the particular query *wrong document* is marked, the new relation in the knowledge database is established.

Auto-tagging mechanism

- The algorithm of auto-adding new tags:
 - All the keywords used in user queries are stored,
 - For each keyword the usage counter and corresponding timestamps are stored,
 - If the keyword is used often enough in the specific period of time (defined in system configuration), then the keyword is added to the tags list,
 - Server application of INSPECTOR searches through each data object (i.e. documents, anomalies, lessons learnt) to localize the new tag in the available data and then to update the knowledge database.

INSPECTOR summary

- Pocket off-line replica of documentation databases,
- Does not rely on Internet connection,
- Advanced search engine using crowdsourcing approach,
- Always ready and effortless,
- Building and exchange of knowledge,
- User-friendly interface,
- Support of most common file types,
- ... thus, INSPECTOR system can be useful support tool for AIT / AIV phase.

Thank you for your attention

Contact persons:

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