B4P

Beyond Former Performance.

A powerful programming language and analytics engine
enabling rapid transformation of big data into powerful insights

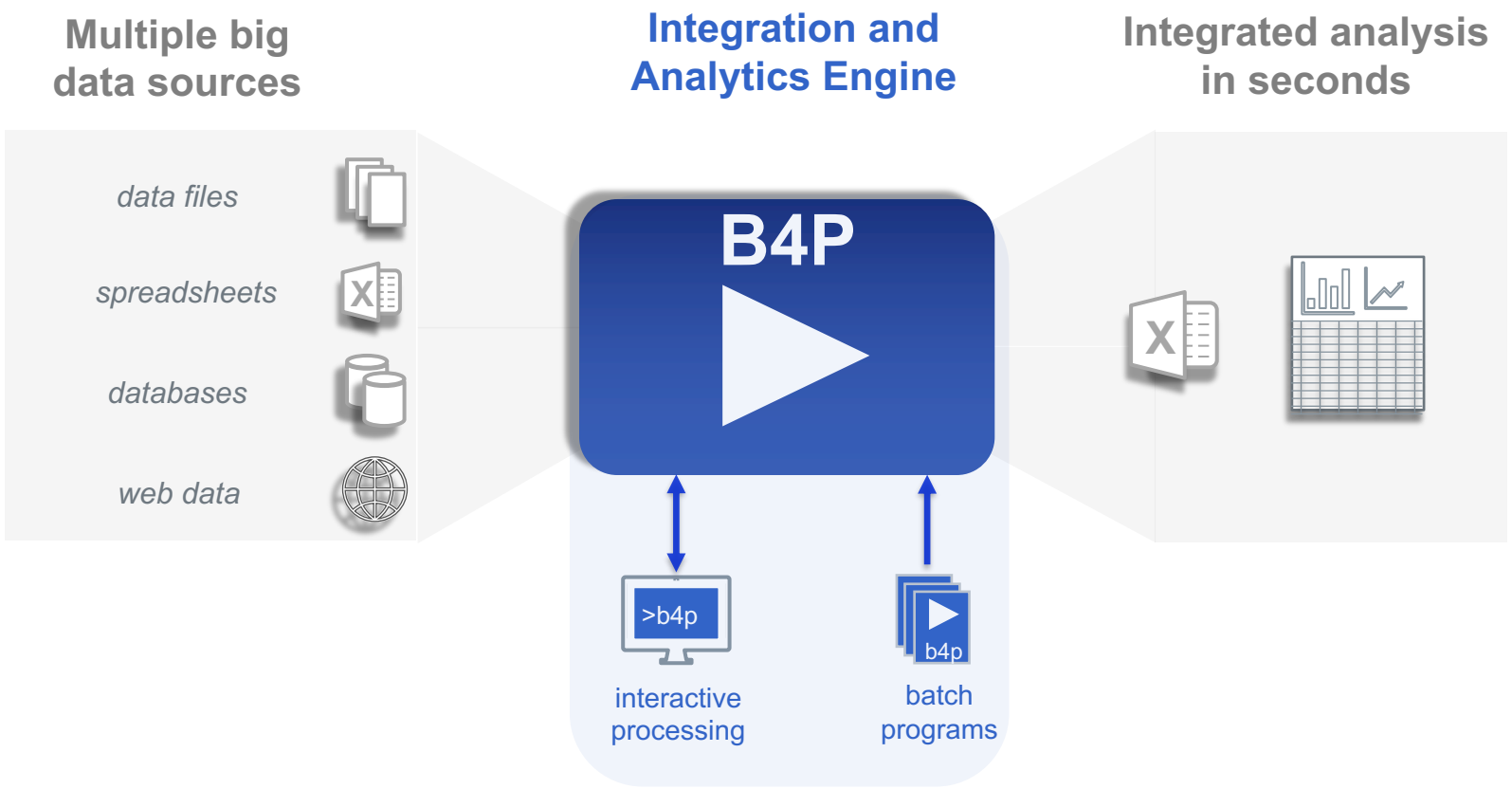
Transforming Big Data into Powerful Insights

Image source: Amir Hanna, Rush Hour in Dubai / UAE, unsplash.com.

Version 8.03 'The Tabulating Machine' (2021-05-27)

B4P Overview

High-Performance Big Data Integration and Analytics Solution



Data Sources and Formats

data files	Excel, CSV, XML, JSON, HTML, Zip, Text (and others)
databases	Database exports (Salesforce, Oracle, SAP, FileMaker, et al)
web data	Internet sources of structured data (websites, web services)
other data	Statistical (R, SAS, SPSS, Stata), PDF (via Tabula)

Outline
B4P Data Integration and Analytics

1. Background and Problem Statement
2. B4P Data Integration and Analytics Engine
3. B4P Language
4. B4P Program Examples
5. B4P Real-world Use Cases

Background and Problem Statement

Current analytics automation tools are unreliable, complex, and expensive

Unreliable:
Excel Macros
(Visual Basic)

- Adequate for simple, small tasks only.
- Coding is cumbersome and cryptic
- Performance is poor if working with large data sets.

Code is opaque, un-auditable, and poorly performing with high risk for error

Complex:
Computer Programming
(Python, R, SAS etc.)

- Requires programming expertise and complex development environment
- Runs fast, but takes a lot of time to program, debug and optimize.
- Others may have difficulties to understand what is written.
- Large, complex code with many functional details coded by hand.

Code difficult to create, comprehend, share, manage, maintain, or adapt

Expensive:
Consultants

- Consultants are happy to solve your problems for cash. Solutions can be decent, but ...
- ... if you need further enhancements, they will ask for more cash.
- You end up depending on them, and you need to repeatedly convince your boss that the updates are worth the money.

Solution is expensive with vendor lock-in and no long-term sustainability

Solution

B4P Big Data Integration and Analytics Engine

Many complex data sources

B4P

1	2	3	4	5	6	7	8
Import	**Clean**	**Validate**	**Merge**	**Augment**	**Analyze**	**Format**	**Export**
▪ Load data from files: Excel, CSV, HTML, XML, JSON, ZIP, TXT ▪ Load data from web pages ▪ Load data from database exports ▪ Search and Identify any files to import	▪ Clean syntax ▪ Check and align headers and structure ▪ Explore and extract sub-tables ▪ Filter out data not needed ▪ Align number formats	▪ Identify relevant data ▪ Harmonize terminologies ▪ Resolve inconsistencies ▪ Fill missing data ▪ Eliminate duplications	▪ Merge multiple tables ▪ Consolidate individual tables ▪ Compare tables ▪ Identify commonalities in multiple tables ▪ Eliminate redundancies	▪ Retrieve data from lookup tables ▪ Add new calculated fields ▪ Enrich the information value	▪ Analyze ▪ Calculate ▪ Pivots ▪ Sort contents ▪ Statistics ▪ Align results	▪ Sort and arrange rows and columns ▪ Format numbers ▪ Add style, formats and colors	▪ Save data to files: Excel, CSV, HTML, XML, JSON, ZIP, TXT ▪ Trigger other tools that data is available

Integrated analysis completed in seconds

Key Components
B4P Language and Data Analytics Engine

B4P Low-Code Language

The B4P Language is a Low-Code, Domain-specific Language designed specifically for tabular data, and has over 800 functions built in.

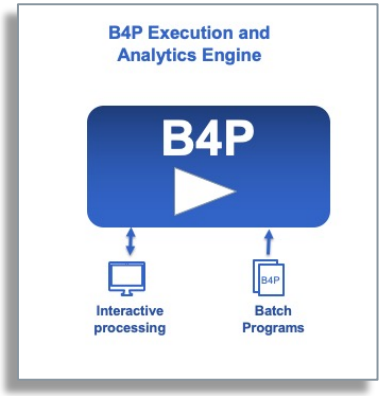
```
table load excel file
table load
table rename column headers
table process selected rows
table merge
table sort rows
table rearrange columns
table save excel file
```

Principle of Low-Code Approach

- **Simple syntax**: Easy to read, learn, understand and run
- **Extensive library:** Over 800 powerful functions built-in, with easy extensibility for new functions.
- **Compact methods** for powerful processing steps eliminates need for complex code, loops, or other administrative overhead.

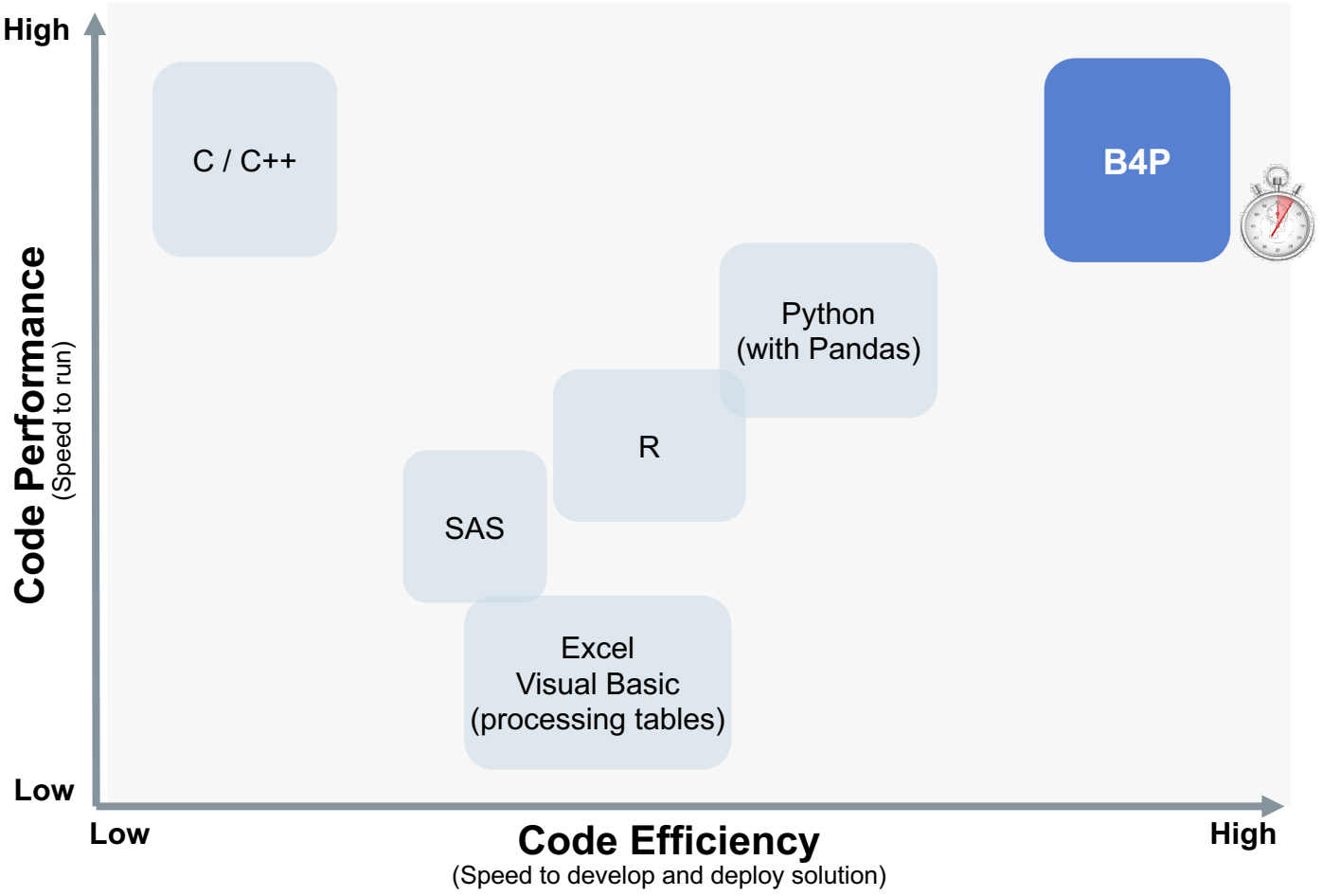
B4P Data Analytics Engine

The B4P Engine is designed for extreme performance managing Big Data – processing tens of millions of rows of data in seconds on commodity personal computers.



- **Fast**: Compiled and runs 'on the metal' to the peak performance of the very latest 8-core and 12-core processors from Intel and Apple (M1).
- **Light weight** (< 3 MB installation footprint).
- **Secure.** No connection to any 'cloud service'. Runs 100% on standalone personal computer fully isolated within the corporate network.
- **Reliability.** Single integrated analytics engine has no dependencies, including network access to any other resources.
- **Many data formats supported**
  (Excel, HTML, XML, JSON, text files, etc., full UNICODE)

B4P Language
Provides Highest Efficiency and Performance



B4P is highest in both Code Performance and Code Efficiency, providing complete solutions with less than 10-20 lines of code

The B4P Language is a Low-Code, Domain-specific Language for tabular data, and has over 800 functions built in.

High Performance and Scalability

- Processes extremely large data (tens of millions of rows) in seconds

High Efficiency and Simplicity

- Single statements replace need for 10-50 lines of code in other languages.

Low Code

- **Delivers solution with minimal coding**
- Maximum functionality with fewest lines of code

Optimized for Simplicity of Coding

- Function library and semantics allow for flexible and powerful operations without loops and variables
- Example: **table process** (...)

Programs are Portable across all Platforms

- B4P program are fully portable, sharable, and executable across all operating systems (Windows, Linux, MacOS) and all computer architecture (Intel x32, x64; ARM M1), assuring maximum re-use across the enterprise.

B4P
Language Features

Simplicity

Easy to read und understand
- Close to natural language.
- Clear syntax easy to read.
- Compact and powerful semantics.

Big Tables are the DNA
- Language semantics are built on processing tables easily.
- No external libraries needed.

Low Code - Very Compact
- Achieve the most with few lines of code in step-by-step approach.
- No hassle with declaring variables, memory management, etc.

High Power Density
- High coding density translates into maximum machine performance.

Performance

Rich Function Library
- More than 800 functions available and growing.
- Many functions process very large tables, sets, matrices and other structures.
- Broad spectrum of other general purpose and file system functions.
- Advanced flow control functions going far beyond *for*, *while* and *if*.

Code in Function Parameters
- B4P supports code passed as parameters to functions which are then executed when needed.
- Makes operations possible without using variables and loops.

Colorful & Formatted Output
- B4P supports a rich library to create Excel and HTML files with rich formatting, auto filters, etc.

Flexibility

Freedom of Naming
- Full naming flexibility (all characters, incl. space) for variables, tables and headers.
- Create variable names from other data, e.g. table header names.
- Multiple word function names

Flexible Variable Structure
- Create and work with simple variables, parameter sets, structures and arrays.
- Supports complex variable tree structures in a simple way.

Libraries
- Import libraries or create your own libraries to optimize your programming efficiency.

Portability

Cross Platform Portability
- B4P programs run under Windows, LINUX and MacOS (incl. M1) without adaptations.
- No need to change path names to run on other OS environments.

File and Data Formats
- Supports CSV, HTML, Excel (with formats), JSON, etc. transparently.

UNICODE
- B4P is fully UNICODE compatible, and accepts all UTF character formats on top of legacy formats.

Standard I/O
- GUI intentionally not supported to preserve cross-platform portability.
- Same console I/O feature set across platforms, incl. text colors.
- Embed B4P in batch programs

The B4P Language allows one to solve complex problems with minimal, simple, clear code
Focus on the *what*, not the *how*.

B4P
Examples

B4P Example #1
Merging Two Soccer Clubs

Football Club Membership

First Name	Family Name	City	Level
Abel	*Amberstone*	*Amsterdam*	*Beginner*
Beata	*Berghill*	*Barcelona*	*Experienced*
Corinne	*Carlson*	*Copenhagen*	*Beginner*
Dietmar	*Davis*	*Dublin*	*Beginner*
Ellen	*Evans*	*Essen*	*Beginner*
Fred	*Fisher*	*Frankfurt*	*Experienced*
Gregory	*Green*	*Gaza City*	*Experienced*
Henry	*Hansson*	*Hamburg*	*Experienced*
Ida	*Ingelberg*	*Ingolstadt*	*Beginner*
John	*Janssen*	*Johannesburg*	*Beginner*
Karl	*Karlsson*	*Kansas City*	*Experienced*

Soccer Club Membership

Level	Town	Last Name	First Name
Questionable	Kyoto	Karlsson	Karl
Novice	London	Lee	Linda
Experienced	Morristown	Miller	Mike
Experienced	New York	Nguyen	Nathali
Experienced	Oslo	Oliveiro	Oscar
Novice	Phoenix	Paulsson	Petra
Novice	Quebec City	Quarles	Quincy
Experienced	Riga	Richardson	Richard
Experienced	San Diego	Stewart	Sandra
Experienced	Tahoma	Turner	Tim
Questionable	Ulm	Ufford	Uwe
Novice	Venice	Viking	Victor

Merged Club Membership

Level	First Name	Last Name	Town
Beginner	Abel	Amberstone	Amsterdam
Beginner	Corinne	Carlson	Copenhagen
Beginner	Dietmar	Davis	Dublin
Beginner	Ellen	Evans	Essen
Beginner	Ida	Ingelberg	Ingolstadt
Beginner	John	Janssen	Johannesburg
Beginner	Linda	Lee	London
Beginner	Petra	Paulsson	Phoenix
Beginner	Quincy	Quarles	Quebec City
Beginner	Victor	Viking	Venice
Experienced	Beata	Berghill	Barcelona
Experienced	Fred	Fisher	Frankfurt
Experienced	Gregory	Green	Gaza City
Experienced	Henry	Hansson	Hamburg
Experienced	Mike	Miller	Morristown
Experienced	Nathali	Nguyen	New York
Experienced	Oscar	Oliveiro	Oslo
Experienced	Richard	Richardson	Riga
Experienced	Sandra	Stewart	San Diego
Experienced	Tim	Turner	Tahoma
Questionable	Uwe	Ufford	Ulm
Questionable or Experienced	Karl	Karlsson	Kyoto or Kansas City

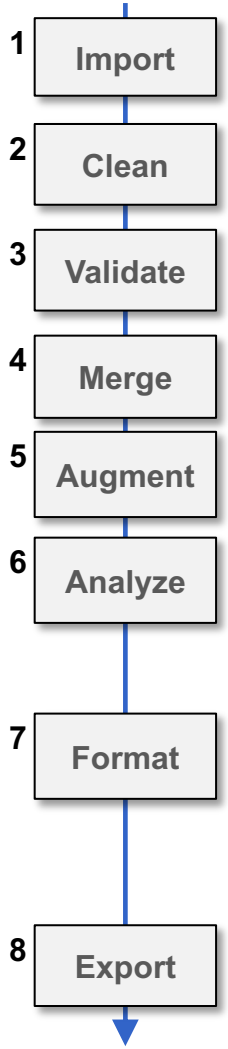
Task

Create a new merged club based on two existing sports clubs

- The tables of the two clubs are arranged differently and use different naming schemes
- Some people are members in both clubs and need to be resolved properly.
- Highlight possible inconsistencies (red text color)

B4P Example #1
Merging Two Soccer Clubs

Solution: 8 Statements *(Optional formatting: 5 Statements)*




```
table load excel file         ( football club, Football Membership List.xlsx );
table load                    ( soccer club,   Soccer Membership List.csv );

table rename column headers.  ( football club, { Family Name, City }, { Last Name, Town } );


table process selected rows.  ( soccer club,   [Level]==Novice, [Level]=Beginner );


table merge                   ( football club, soccer club,
                                      {Last Name,First Name},{Level,Town},append," or " );




table sort rows               ( soccer club,   { Level, Last Name,  First Name });
table rearrange columns       ( soccer club,   { Level, First Name, Last Name, Town } );


table style table             ( soccer club, sheet, freeze rows, 1, autofilter, 0 );
table style auto width        ( soccer club );
table style rows              ( soccer club, 0, sheet, boldface, true, fill color, gray 15 );

table process selected rows   ( soccer club, ([Level] = '*Questionable*'),
      table style cells       ( soccer club, Level, row(), single, text color, red ) );


table save excel file         ( soccer club, Soccer Club, New Soccer Club Membership.xlsx );
```

Plain English multi-word names
- Functions, variables, tables, etc.

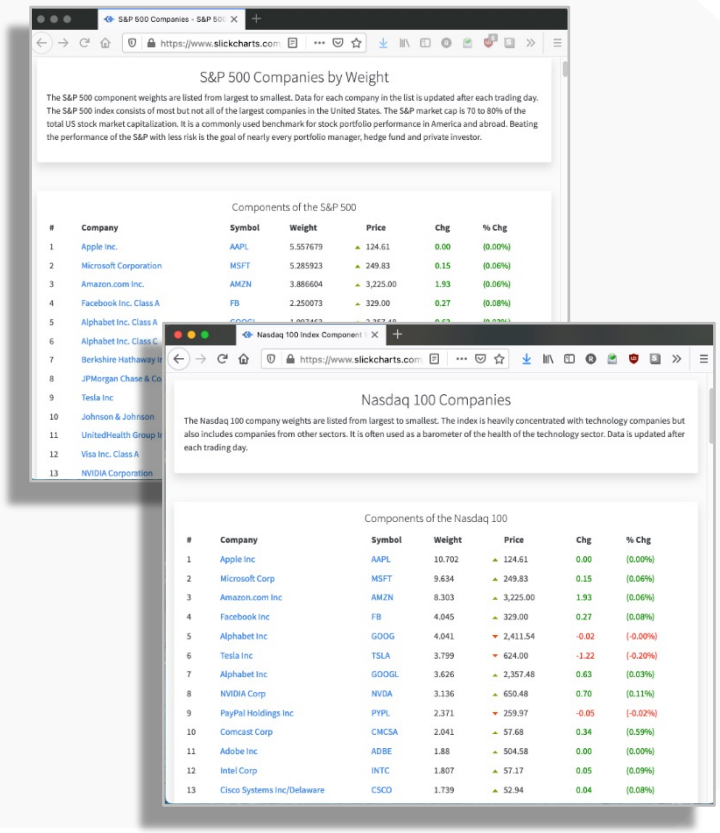
Simple business logic
- No or minimal loops or variables needed for coding

Portability ensured
- Statements are independent from platform and output format

Powerful formatting functions
- Small number of statements suffice

Full Excel support
- Loading and saving
- Full data transparency

B4P Example #2
Combining Stock Data: S&P 500 and NASDAQ 100



B4P

#	Company	Symbol	Price	Chg	% Chg	Weight sp500	Weight nasdaq10
1	3M Company	MMM	175	0.21	0.12%	0.318459	
2	A. O. Smith Corporation	AOS	54.82	0	0.00%	0.023472	
3	ABIOMED Inc.	ABMD	326.6	2.4	0.74%	0.046276	
4	AES Corporation	AES	23.7	0.2	0.85%	0.049417	
5	AMETEK Inc.	AME	120.94	0	0.00%	0.087884	
6	ANSYS Inc.	ANSS	363.8	0	0.00%	0.098729	0.258
7	ASML Holding NV	ASML	486.99	-0.73	-0.15%		0.305
8	AT&T Inc.	T	28.76	0	0.00%	0.647313	
9	AbbVie Inc.	ABBV	107.15	0	0.00%	0.597494	
10	Abbott Laboratories	ABT	109.49	0	0.00%	0.612924	
11	Accenture Plc Class A	ACN	261.21	0	0.00%	0.522713	
12	Activision Blizzard Inc.	ATVI	92.85	0	0.00%	0.226706	0.593
13	Adobe Inc.	ADBE	500.1	-0.02	0.00%	0.757774	1.984
14	Advance Auto Parts Inc.	AAP	157.51	0	0.00%	0.033788	
15	Advanced Micro Devices Inc.	AMD	91.66	-0.05	-0.05%	0.348385	0.912
16	Aflac Incorporated	AFL	44.47	0	0.00%	0.091757	
17	Agilent Technologies Inc.	A	118.49	0	0.00%	0.114563	
18	Air Products and Chemicals Inc.	APD	273.22	0	0.00%	0.190791	

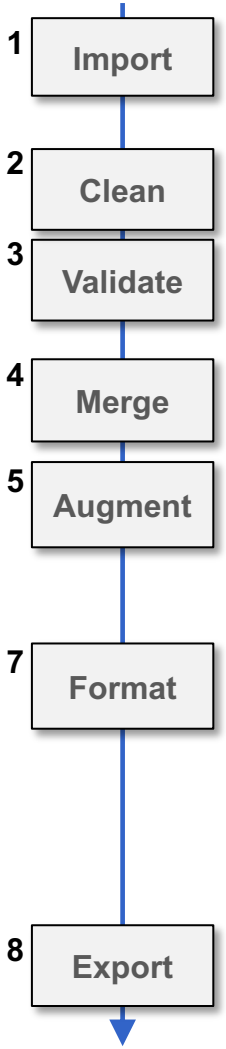
Task

Import the real-time online S&P 500 and NASDAQ 100 stock information merge them

- Data source1: https://www.slickcharts.com/nasdaq100
- Data source2: https://www.slickcharts.com/sp500
- Some companies are listed in only one of them, others are listed in both.
- Combine the information, show weighting in the two listings and color code trends (positive/negative)

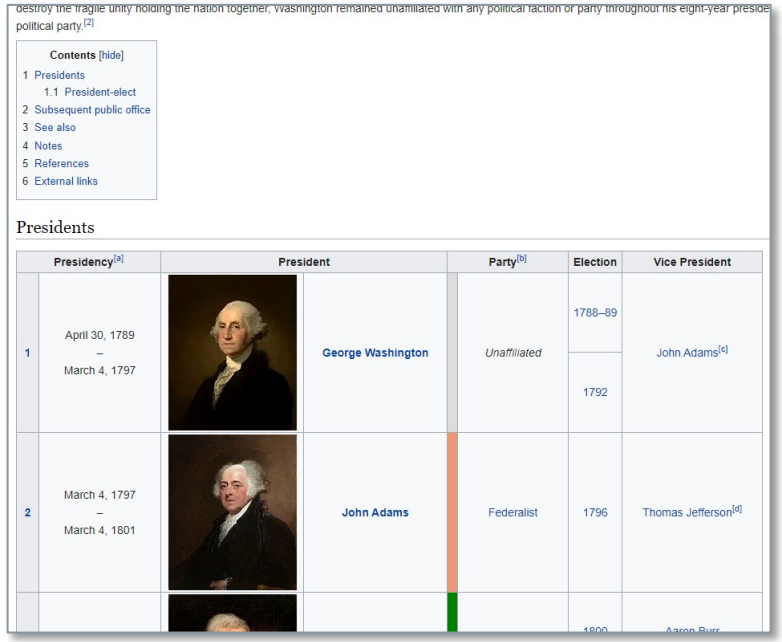
B4P Example #2
Combining Stock Data: S&P 500 and NASDAQ 100

Solution: 12 Statements *(Optional formatting: 6 Statements)*




```
for all parameters ( {nasdaq100, sp500} , listing[] )
{
     file download overwrite ( "https://www.slickcharts.com/" + listing[], listing[] + .html);
     table load              ( listing[], listing[] + .html,  HTML, "Components of the" );
     table clean             ( listing[], trim spaces );
     table process           ( listing[], ['% Chg']=smart numeral( middle( ['% Chg'], '(',')' )); [Price]=clean numeral([Price]) );
     table rename column headers  ( listing[], "Weight", "Weight " + listing[] ); // Weights are specific to Nasdaq and S&P
}


table merge extend columns   ( nasdaq100, sp500, Symbol );
table rename                 ( sp500, stocks );

table sort rows              ( stocks, Company );
table process                ( stocks, ['#'] = row() ); // Number the items

table rearrange columns      ( stocks, { '#', Company, Symbol, Price, Chg, '% Chg' } ); // Weightings follow afterwards


table style auto width       ( stocks );
table style theme            ( stocks, Zebra Vertical Lines, pattern, 2, table, "gridlines, false" );
table process                ( stocks, // Negative numbers: red; positive numbers: navy blue
    table style cells        ( stocks, { 'Chg', '% Chg' }, { 2: row() }, single, text color, select if ( [Chg]>0, navy, red ) ) );
table style columns          ( stocks, '% Chg', sheet, number format, "0.00%" ); // Value to show as percent.
table style table            ( stocks, sheet, freeze rows, 1, autofilter, 0);



table save excel file        ( stocks, "NASDAQ and SP500", Stocks.xlsx );
```

B4P Example #3
Analyzing all Presidents in Wikipedia



destroy the fragile unity holding the nation together. Washington remained unaffiliated with any political faction or party throughout his eight-year preside political party.[2]

Contents [hide]

1 Presidents
1.1 President-elect
2 Subsequent public office
3 See also
4 Notes
5 References
6 External links

Presidents

	Presidency[a]		President	Party[b]	Election	Vice President
1	April 30, 1789 – March 4, 1797		George Washington	*Unaffiliated*	1788–89 1792	John Adams[c]
2	March 4, 1797 – March 4, 1801		John Adams	Federalist	1796	Thomas Jefferson[d]
					1800	Aaron Burr

Presidenc	Presidency (1)	President	Party	Election	Vice President
1	April 30, 1789 – March 4, 1797	George Washington	Unaffiliated	1788–89, 1792	John Adams,
2	March 4, 1797 – March 4, 1801	John Adams	Federalist	1796	Thomas Jefferson
3	March 4, 1801 – March 4, 1809	Thomas Jefferson	Democratic-Republican	1800, 1804	Aaron Burr, George Clinton
4	March 4, 1809 – March 4, 1817	James Madison	Democratic-Republican	1808, 1812	, Vacant after Apr. 20, 1812, Elbridge Gerry, Vacant after Nov. 23, 1814
5	March 4, 1817 – March 4, 1825	James Monroe	Democratic-Republican	1816, 1820	Daniel D. Tompkins,
6	March 4, 1825 – March 4, 1829	John Quincy Adams	Democratic-Republican	1824,	John C. Calhoun,
7	March 4, 1829 – March 4, 1837	Andrew Jackson	Democratic	1828, 1832	, Vacant after Dec. 28, 1832, Martin Van Buren
8	March 4, 1837 – March 4, 1841	Martin Van Buren	Democratic	1836	Richard Mentor Johnson
9	March 4, 1841 – April 4, 1841	William Henry Harrison	Whig	1840	John Tyler
10	April 4, 1841 – March 4, 1845	John Tyler	Whig		Vacant throughout presidency,
11	March 4, 1845 – March 4, 1849	James K. Polk	Democratic	1844	George M. Dallas

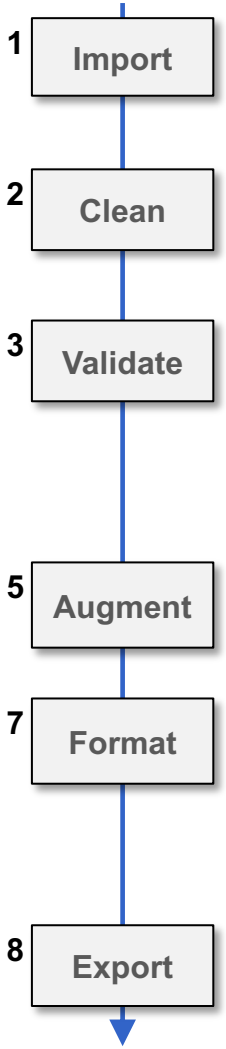
Task:

Download the list of Presidents and generate Excel table with one president per row.

- Data source: https://en.wikipedia.org/wiki/List_of_presidents_of_the_United_States
- Some Presidents won multiple election terms
- Ignore the portraits
- Some vice presidents had deviating terms
- Remove redundant artefacts, e.g. cross-referencing symbols
- Generate a nice table with **parties colored differently**

B4P Example #3
Analyzing all Presidents in Wikipedia

Solution: 9 Statements *(Optional formatting: 7 Statements)*



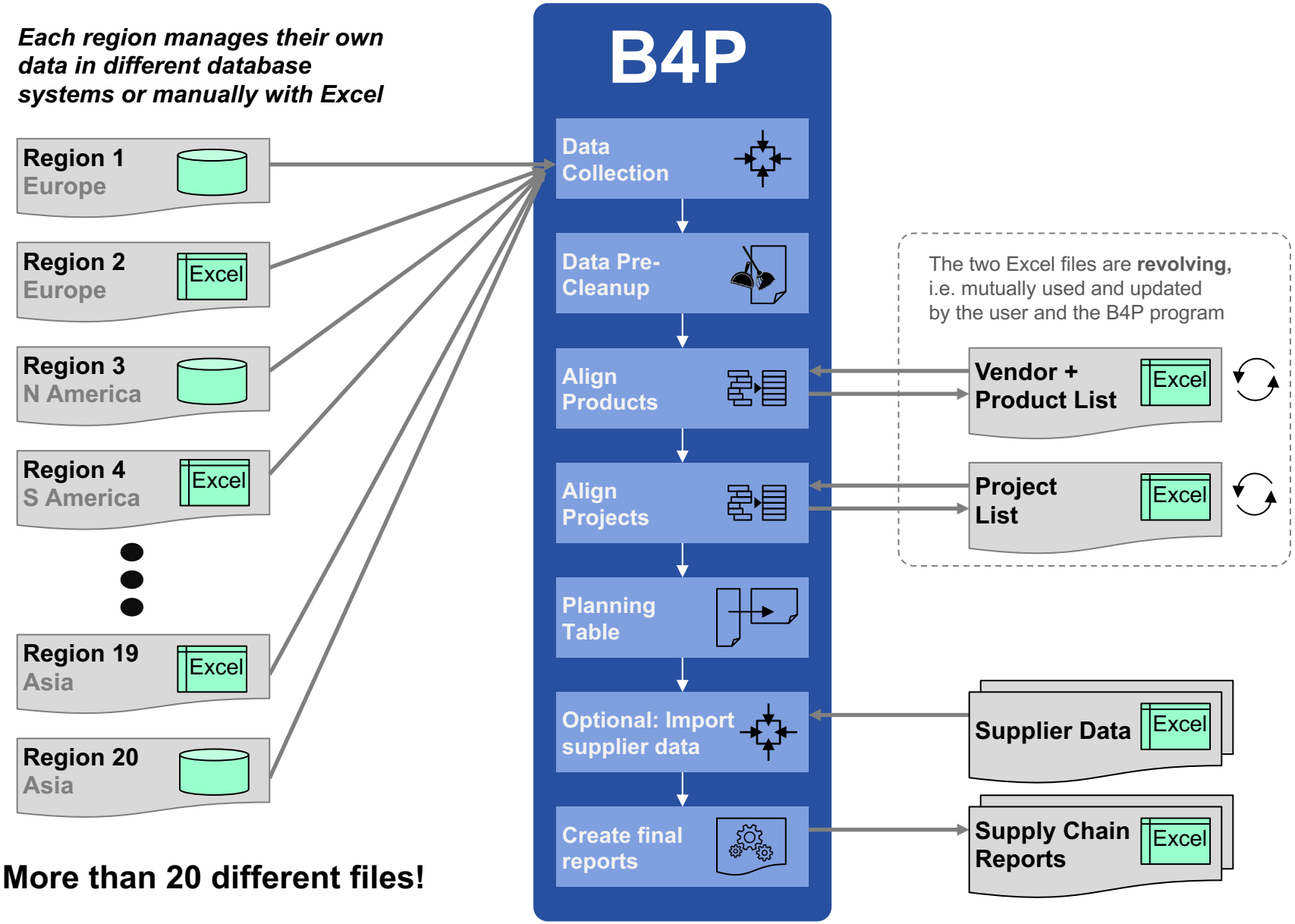

```
include ( Style Library );
file download overwrite      ( "https://en.wikipedia.org/wiki/List_of_presidents_of_the_United_States", presidents.html );
table load                   ( presidents, presidents.html, HTML, 'id="Presidents"' );


// Strip all footnote references and new lines in the fields, and the last table row with footnotes inside
table delete rows            ( presidents, table length( presidents ) -1 ); // -1 = Last Row (negative indexing)
table process all cells      ( presidents, [.] = replace all( literal([.]), { '[?]', new line, '- '}, {'','','-' } ) );

// Remove the blank column originally containing portraits and put president name into all rows
table delete columns         ( presidents, {Portrait, Party } );
table rename column headers  ( presidents, {"Presidency (1)", "Party (1)"}, {Period, Party} );
table fill vertically        ( presidents, President );
table consolidate            ( presidents, President, { Election, Vice President }, append, ", " );


// Define party colors
table initialize             ( party colors, {{ Party Name, Colors },
     {{ Party Name,     Colors }, { Democratic,   azur    }, { Republican, imperial red },
      { Federalist,     coral  }, { Whig,         yellow  }, { "Democratic-Republican", excel light green },
      { National Union, ocre   }, { Unaffiliated, gray 15 }  } );

// Add some colors and styles
table process                ( presidents, table style cells( presidents, Party, row(), single,
                                           fill color, [ party colors : Party Name, [Party], Colors ] ) );
table style columns          ( presidents, { "Presidency (1)", "President", "Vice President" }, sheet, column width, 30 );
table style columns          ( presidents, { Party, Election }, sheet, column width, 20, horizontal align, middle );
table style rows             ( presidents, 0, table, boldface, true );
table style table            ( presidents, sheet, wrap text, true, autofilter, 0, freeze rows, 1 );

table save excel file        ( presidents, All U.S. Presidents, presidents.xlsx );
```

B4P
Real-World
Use Cases

B4P Real-world Use Case #1

Integrate corporate data from 20 branch offices worldwide

Each region manages their own data in different database systems or manually with Excel



More than 20 different files!

1. Load Data from all Sources
- The data from different sites originate from 20 different database exports or manually prepared Excel files

2. Clean-Up and Harmonize
- Harmonize data formats to week numbers and years

3. Align Product Information
- The revolving table manages the products to include and allow for using harmonized product names.
- Orientation is by common product identification number.

4. Align Project Information
- Different project names and/or abbreviations are used by the sites. They will be aligned.

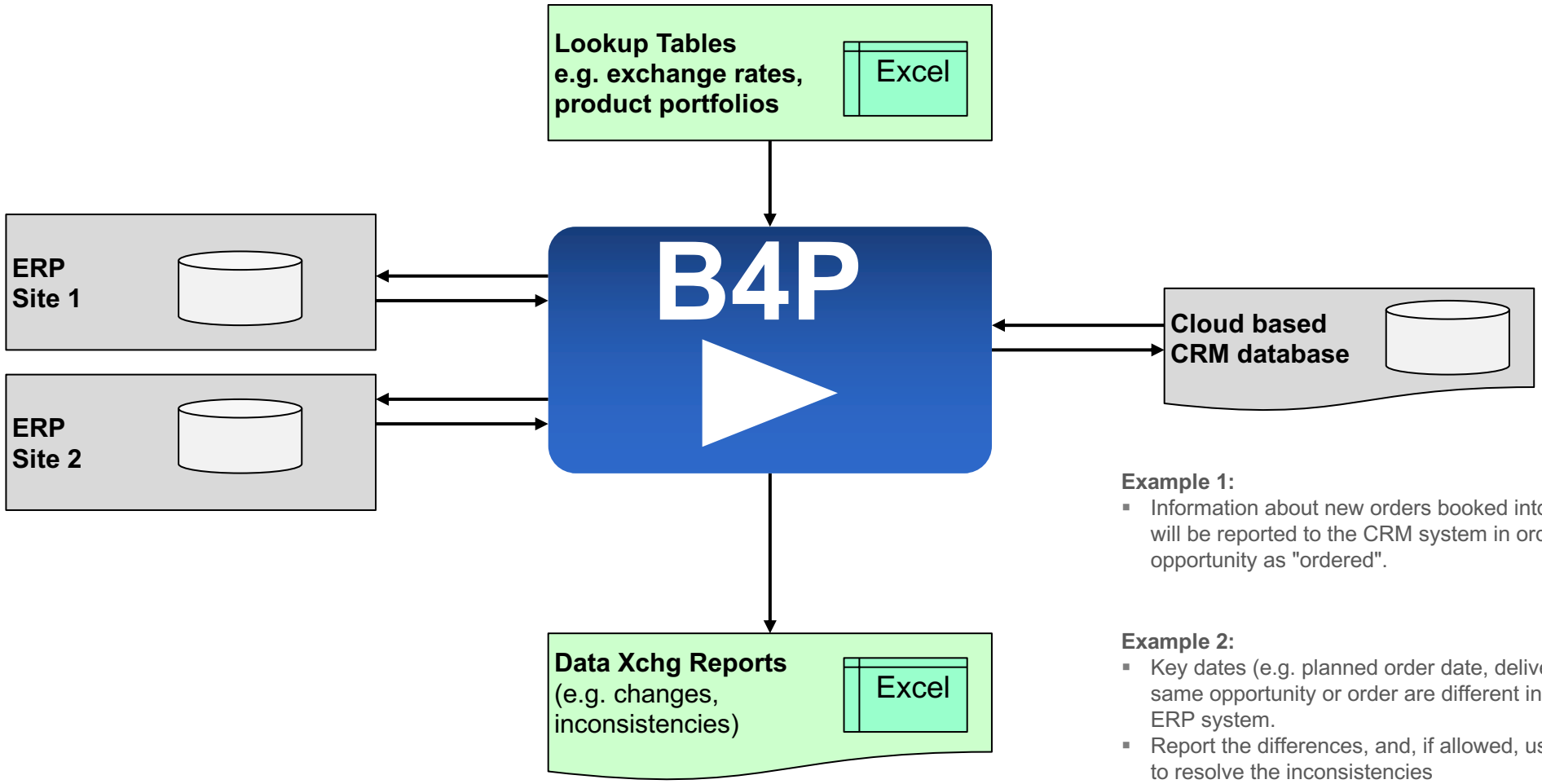
5. Project Name Alignment
- The sequential list of individual demands is transformed to a horizontal planning table with weekly schedule.
- Information consolidation and summing up

6. Import supplier planning data
- If supply info is available, then match demand with their delivery plans

7. Reports
- Detailed internal reports for performance monitoring
- Condensed reports for suppliers

B4P Real-world Use Case #2

Information interchange between multiple different databases



Example 1:

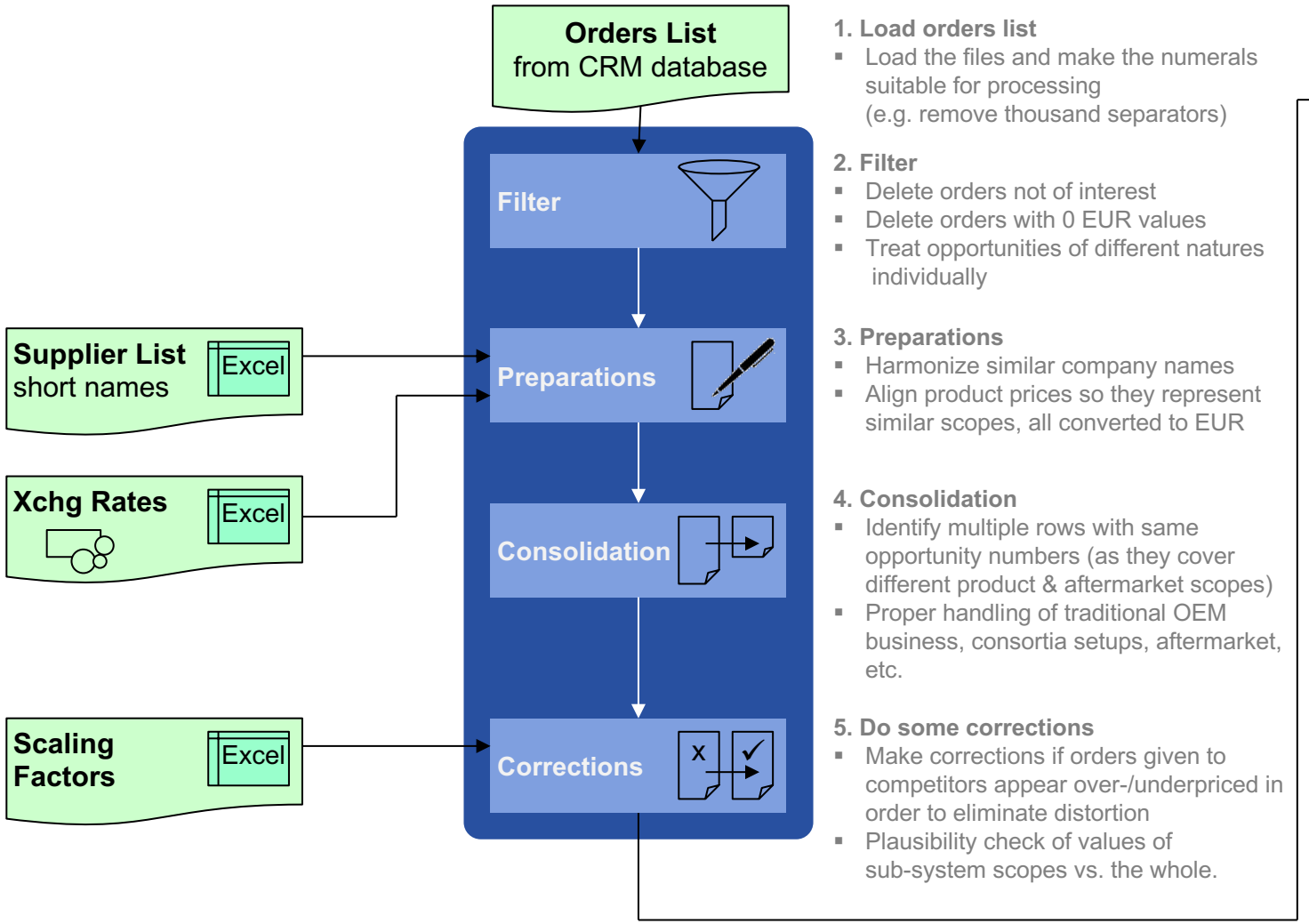
- Information about new orders booked into the ERP system will be reported to the CRM system in order to mark the opportunity as "ordered".

Example 2:

- Key dates (e.g. planned order date, delivery dates) for the same opportunity or order are different in the CRM and ERP system.
- Report the differences, and, if allowed, use automated rules to resolve the inconsistencies

B4P Real-world Use Case #3

Enriched Business Intelligence from many data sources



1. Load orders list
- Load the files and make the numerals suitable for processing (e.g. remove thousand separators)

2. Filter
- Delete orders not of interest
- Delete orders with 0 EUR values
- Treat opportunities of different natures individually

3. Preparations
- Harmonize similar company names
- Align product prices so they represent similar scopes, all converted to EUR

4. Consolidation
- Identify multiple rows with same opportunity numbers (as they cover different product & aftermarket scopes)
- Proper handling of traditional OEM business, consortia setups, aftermarket, etc.

5. Do some corrections
- Make corrections if orders given to competitors appear over-/underpriced in order to eliminate distortion
- Plausibility check of values of sub-system scopes vs. the whole.

6. Expand
- Expand opportunities with multiple equipment suppliers into multiple rows and list the suppliers separately

7. Derive Equipment Values
- Derive equivalent equipment values
- Plausibility checks + adjustments against upper and lower boundaries.

8. Final cleanup
- Keep and rearrange columns of interest,
- Discard the rest
- Numeric output in commercial format

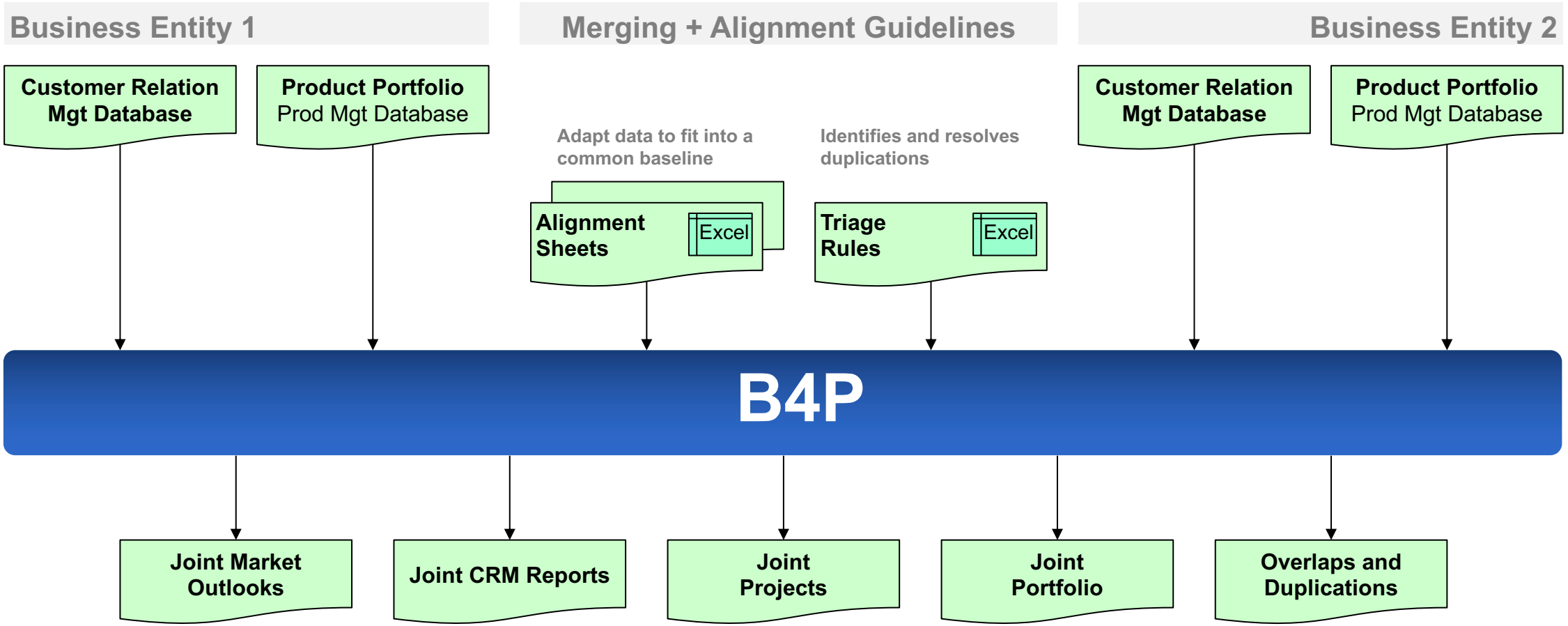
Use Excel to visualize
- Market development over time
- Market development across regions
- Market share among suppliers
- Identifying market disruptions
- etc.

ERP = Enterprise Resource Management Databases (e.g. SAP, Oracle, BAAN, Abacus)

CRM = Customer Relationship Database (e.g. Salesforce)

B4P Real-world Use Case #4
Merger and Acquisition

During the business integration, the two organization, even their individual sites will continue using their information repositories for a certain time until the business integration process has been finalized.



Strategic and Operational Use Cases
B4P

Strategic Use Cases

Business and Market Analytics
- Processing big data collected from (empirical) market assessments to derive market trends, value-adding conclusions and outlooks.
- Powerful analysis of financial and market data for your investment decisions.

Mergers and Acquisitions
- Providing joint information analysis from both parties which (still) maintain two different databases and ways of working, ready for presentation.
- Swift generation of new data structures and database based on multiple legacy databases helpful for the business integration process

Big Data
- Extract the most essential information from raw big data collections

Data Integrity Verification
- Analyze financial, logistics, operational and CRM data for integrity and validity. Generate lists of suspected shortcomings and correct them.

Engineering and Technical Applications
- Analyze simulation results and identify information patterns of interest.
- Analyze commonalities of multiple bills of material.
- Automatic documentation compilation and staging of software projects (Example: Complete B4P online documentation created with B4P)

Operational (Everyday Life) Use Cases

Efficient Reporting
- Collect and condense large base data in order to extract essential information required for periodic reporting and presentation.
- Validation: Compare the data with rules, best practice patterns, etc.
- Identify all potential deviations and help to explain abnormalities effectively towards senior management.
- Complement or enrich the data with supporting information.
- Provide the data in a form so using Excel is the final step to do the creativity work, e.g. making convincing charts.

Repeating Procedures
- Save significant working time by automating repeating work patterns where Excel is used to collect, compile and analyze data.
- Benefit: Saving time and making significantly less mistakes

Gather and Track Key Performance Indicators (KPI)
- Gather data from different sources, validate and provide updated KPI's
- Highlight root causes of possible abnormalities (e.g. discontinuities)

Leverage Information Awareness
- Create an information environment where you are alerted in an early phase in case of any abnormalities or changes of particular interest.

Reliable data analytics generates the correct conclusions giving your business the critical competitive advantage

B4P

Beyond Former Performance.

Information *www.b4p.app*

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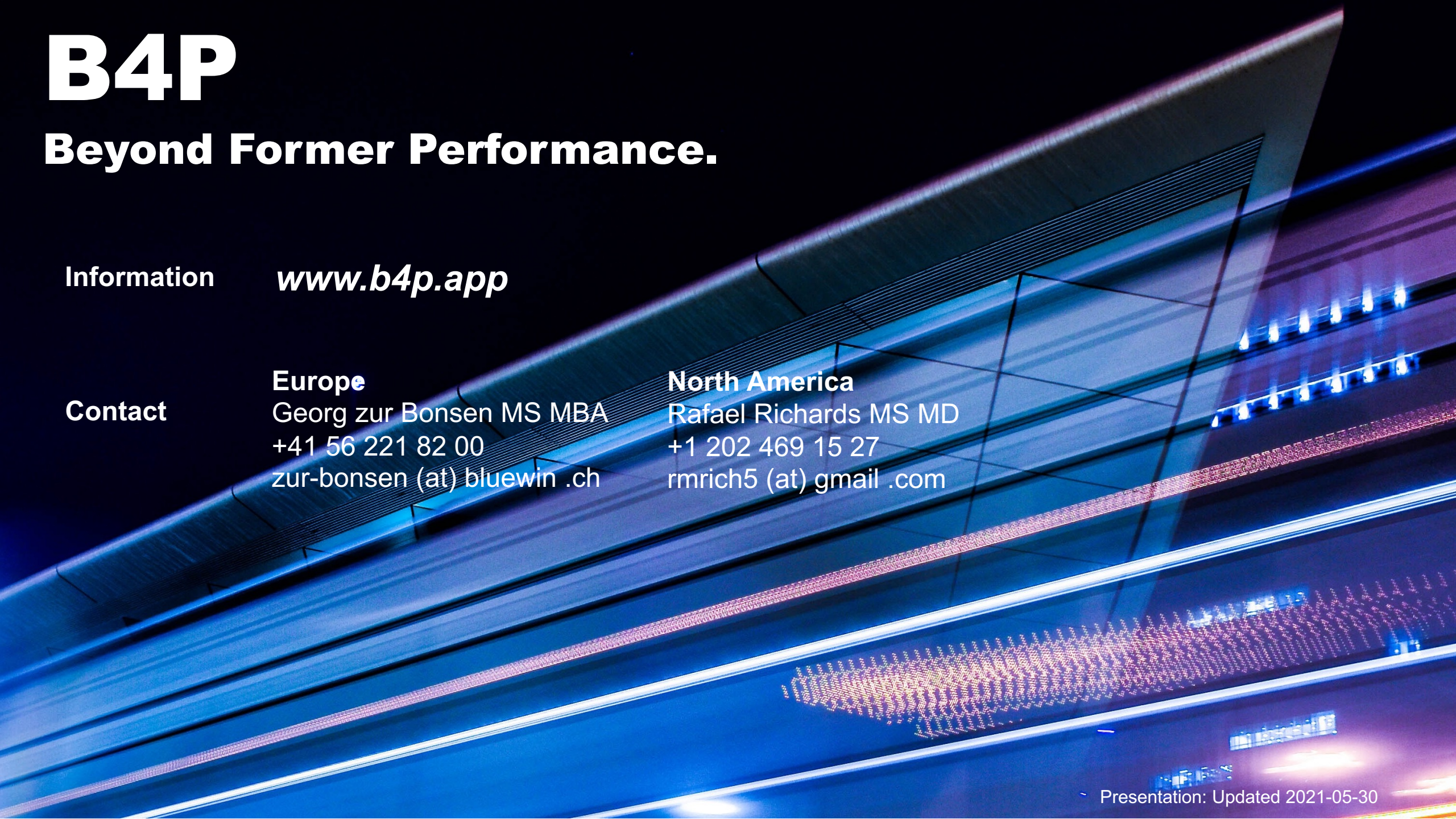

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