PARANÁ STATE
STATE FINANCE SECRETARIAT

RECEITA ESTADUAL
REVENUE COORDINATION

Analytics in the Age of Electronic Invoicing and Digital Bookkeeping

TERADATA UNIVERSE 2018

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Brazil's economy have gone digital. Practically all transactions (business to business and business to consumers) occur in digital format, to comply with the tax code. This means that electronic invoicing and digital bookkeeping became a common place, and the amount of data generated is staggering. How can a tax administration cope with this data growth in order to keep control of its tax base and at the same time change the way its tax auditors perform their work in this paperless reality?

Summary

- **Chapter One** - Paraná State
- **Chapter Two** - Electronic Invoicing & Digital Bookkeeping
- **Chapter Three** - Architecture, Usage & Processes
- **Chapter Four** - Example of Analytics for Tax Audits... and a Bird's View of Our Self-Service BI
- **Chapter Five** - Some Solutions & Benefits
- **Chapter Six** - What Are They Saying?

Chapter One

Paraná State

Paraná State, Brazil

5th largest economy in Brazil
(São Paulo, Minas Gerais, Rio de Janeiro, Rio Grande do Sul)

300,000+ corporate tax payers (VAT)

Area (km²): 199,880 *(England: 130,279)*

Population: 10,444,526 *(5.5% of Brazil's pop.)*

State Capital:
Curitiba

399 municipalities

STATE TAX	REVENUE (%)
Tax on the circulation of goods and interstate and inter-municipal transportation and communications services (ICMS) That's our "VAT"	88.9
Tax on property of automotive vehicles (IPVA)	6.1
Tax on property "causa mortis" transmission and donations (ITCMD)	0.7
General Fees	4.3

Chapter Two

Electronic Invoicing & Digital Bookkeeping

Agreement 115/03

Since 2003, Brazilian corporate taxpayers from telecommunications and electric distribution industries are required to record electronically every transaction and file all their invoices (TXT format) with the state tax administration.

- **This means all electric and phone bills (invoices), in text files with digital signature.**

Public Digital Bookkeeping System (SPED)

Since 2008, companies are required to provide information about their transactions using digitally signed documents. There are, for VAT purposes, two main requirements for Brazilian corporate taxpayers:

- **They have to submit to the tax administration, for prior approval, all their invoices. In this case, we have three types of electronic invoicing: the NF-e, the CT-e and the NFC-e.**

- **They are also required to monthly report their tax bookkeeping in a digital file (TXT format), containing all their purchases and sales (invoices), along with several other information.**

Types of Electronic Invoices and Digital Tax Bookkeeping in Brazil

Circulation of goods

Industry/Wholesale: NF-e

Retail: NFC-e

Energy Distribution: Agreement 115/03

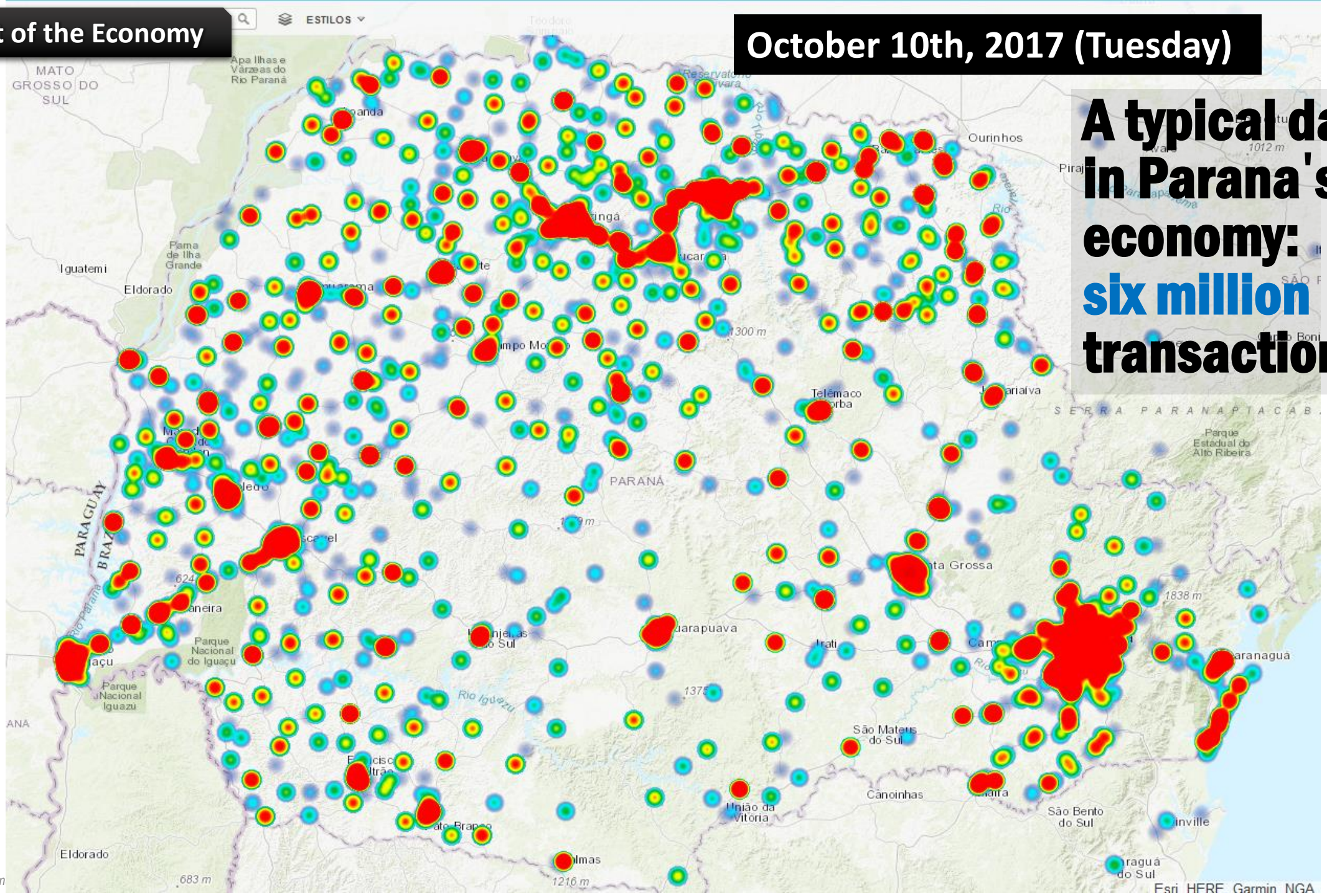
Inter-municipal transportation services: CT-e

Telecommunication services: Agreement 115/03

All aforementioned invoices, and many other information, must also be filed within the Digital Tax Bookkeeping: EFD

The Heat of the Economy

October 10th, 2017 (Tuesday)



A typical day in Parana's economy: six million transactions

Chapter Three

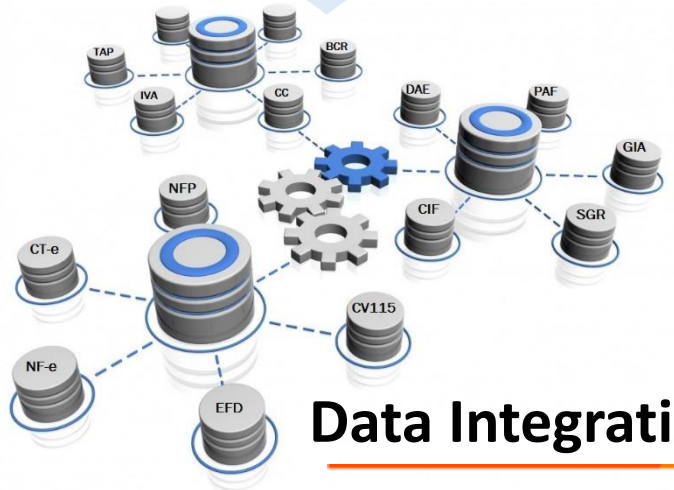
Architecture, Usage & Processes

Analytics Architecture

325 million documents per month

- **175M** invoices
- **150M** tax bookkeeping

- NF-e 21M
- CT-e 4M
- NFC-e 120M
- EFD 150M
- Agreement 115/03 30M



Data Integration

Informatica

Data Warehouse

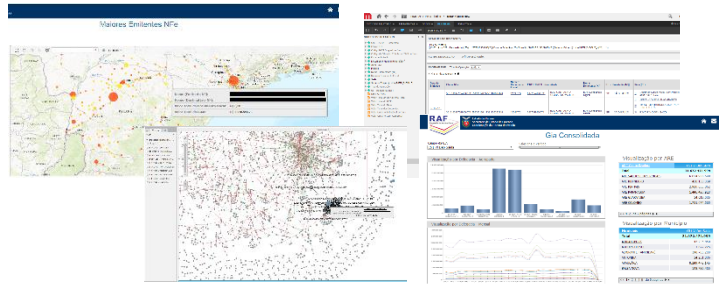
TERADATA IntelliFlex

TERADATA

Intelliflex on-premises & as a service

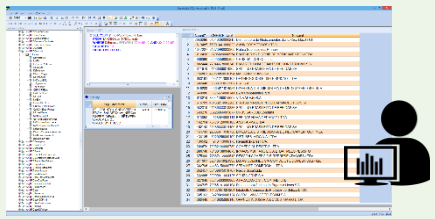
hadoop

Hadoop Integration planned for late 2018



Business Intelligence & Data Discovery

MicroStrategy

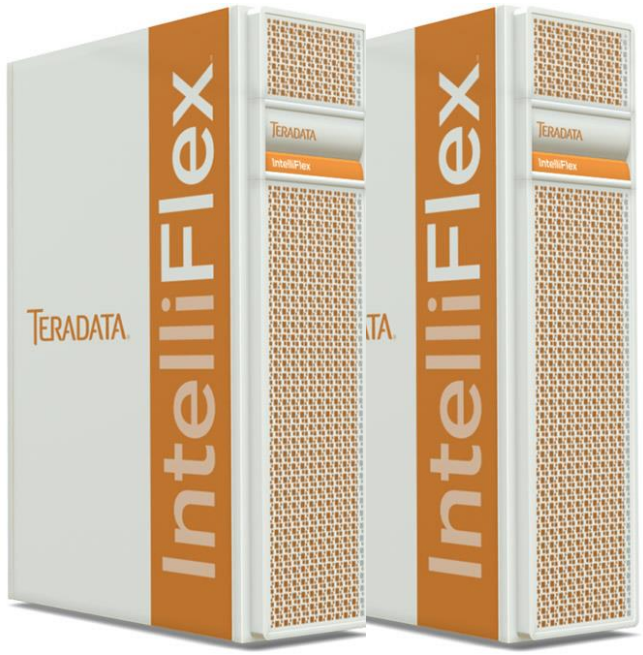


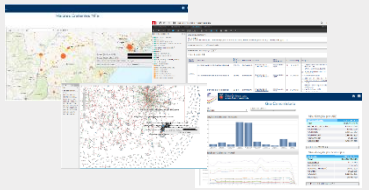
Power Users

Applications

Tax Auditors Doing Analytics

We have a total of **640** tax auditors (considering all staffing levels)

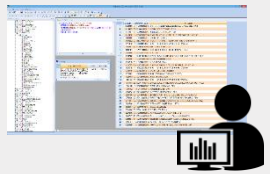




Business Intelligence & Data Discovery

MicroStrategy

330 tax auditors



Power Users

30 tax auditors

MONTHLY AVERAGE

50K queries

4B result set rows

What Do We Do With All This Data?

Virtually all businesses processes related to tax enforcement depend strongly on analytics, such as:

- analysis on tax refund for “tributary substitution” (special tax collection regime)
- persistent debtor program
- analysis on administrative processes (requests and appeals)
- special ad-hoc project audits
- voluntary disclosure special program
- screening processes for tax fraud
- analysis on inconsistencies by "Simples Nacional“ (special regime for SMB)
- tax audits and tax enforcement planning
- taxpayer monitoring

Chapter Four

Example of Analytics for Tax Audits... and a Bird's View of Our Self-Service BI

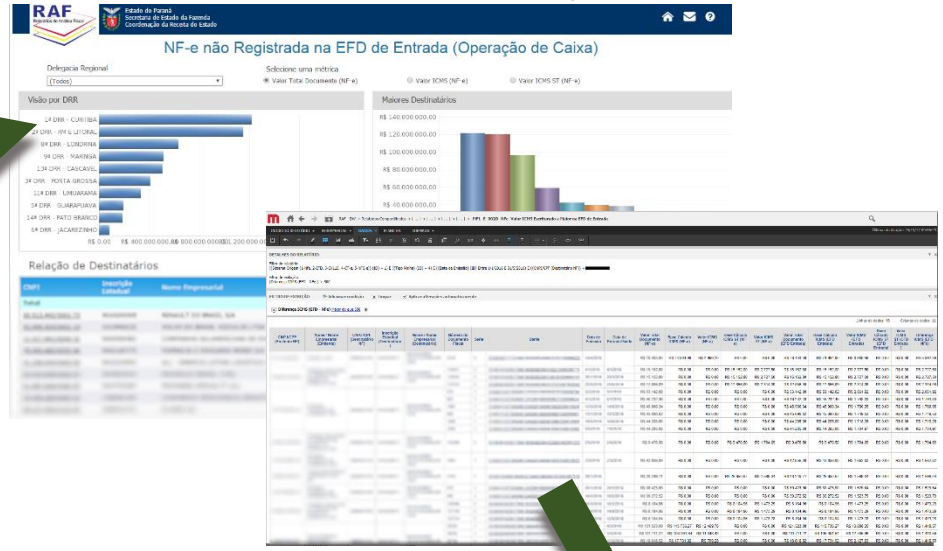
Screening Processes for Tax Fraud

Automated screening processes for Tax Fraud are routinely performed in the Teradata DW.

Tens of billions of records are crunched in less than one hour.

**** We do NOT use data mining techniques… yet***

Using MicroStrategy, the data is then made available in dashboards and reports.

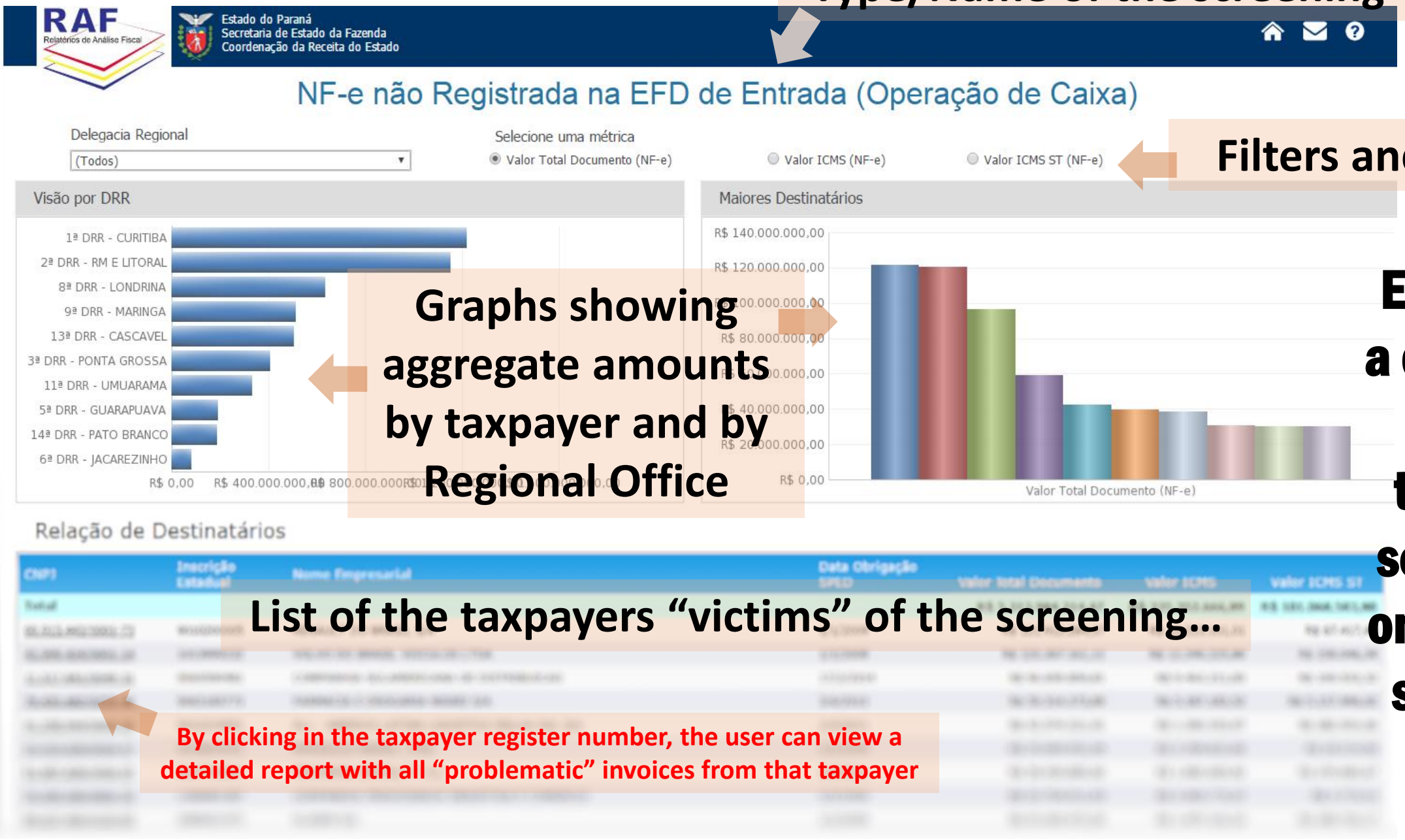


Screening: predetermined set of rules to compare data from transactions (invoices and tax bookkeeping) between buyers and sellers.

Actions can then be taken to investigate the flagged taxpayers.

Screening Processes for Tax Fraud – Dashboard Example

Type/Name of the screening



Filters and options

Graphs showing aggregate amounts by taxpayer and by Regional Office

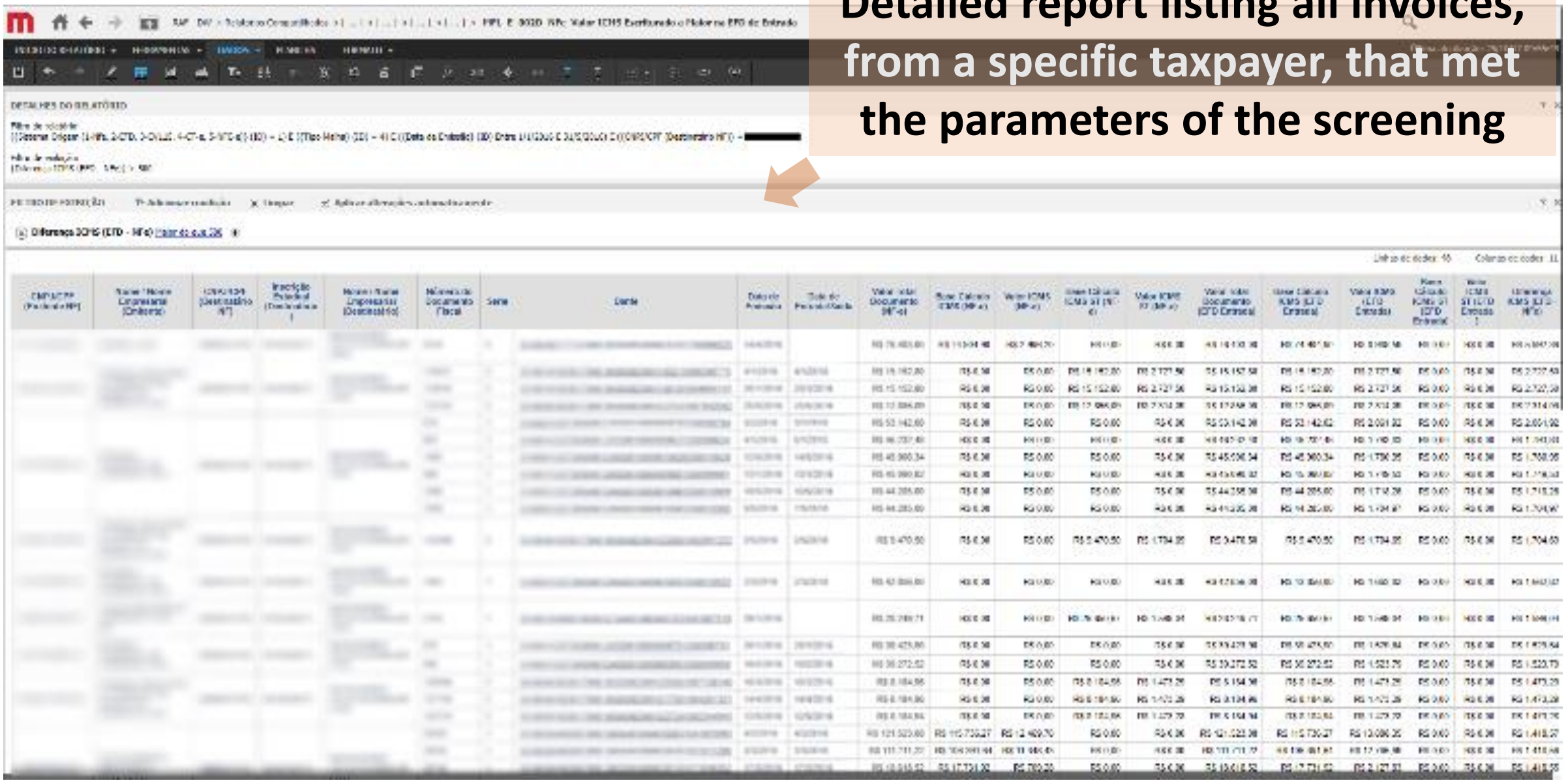
Example of a dashboard showing taxpayers selected by one specific screening

List of the taxpayers "victims" of the screening…

By clicking in the taxpayer register number, the user can view a detailed report with all "problematic" invoices from that taxpayer

Screening Processes for Tax Fraud – Report Example

Detailed report listing all invoices, from a specific taxpayer, that met the parameters of the screening



BUT...

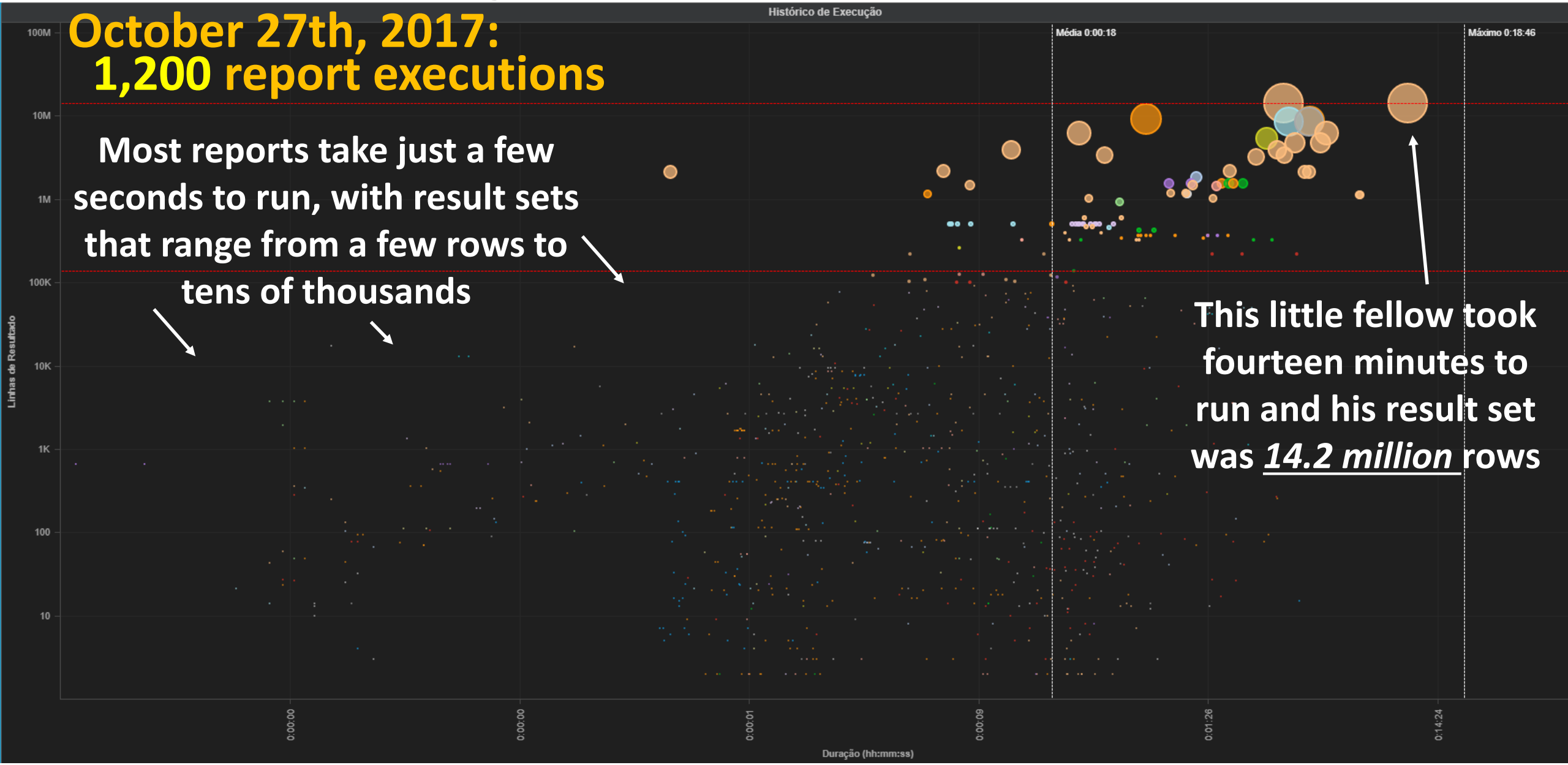
...what our tax auditors **really, really** like to do is...

Image: O-que-é-Self-Service-BI.jpg - https://taticview.com/pt/o-que-e-afinal-esse-self-service-bi/

...to create their own reports!

A Typical Reporting Day

These are the report executions from tax auditors with privilege to create/run their own reports

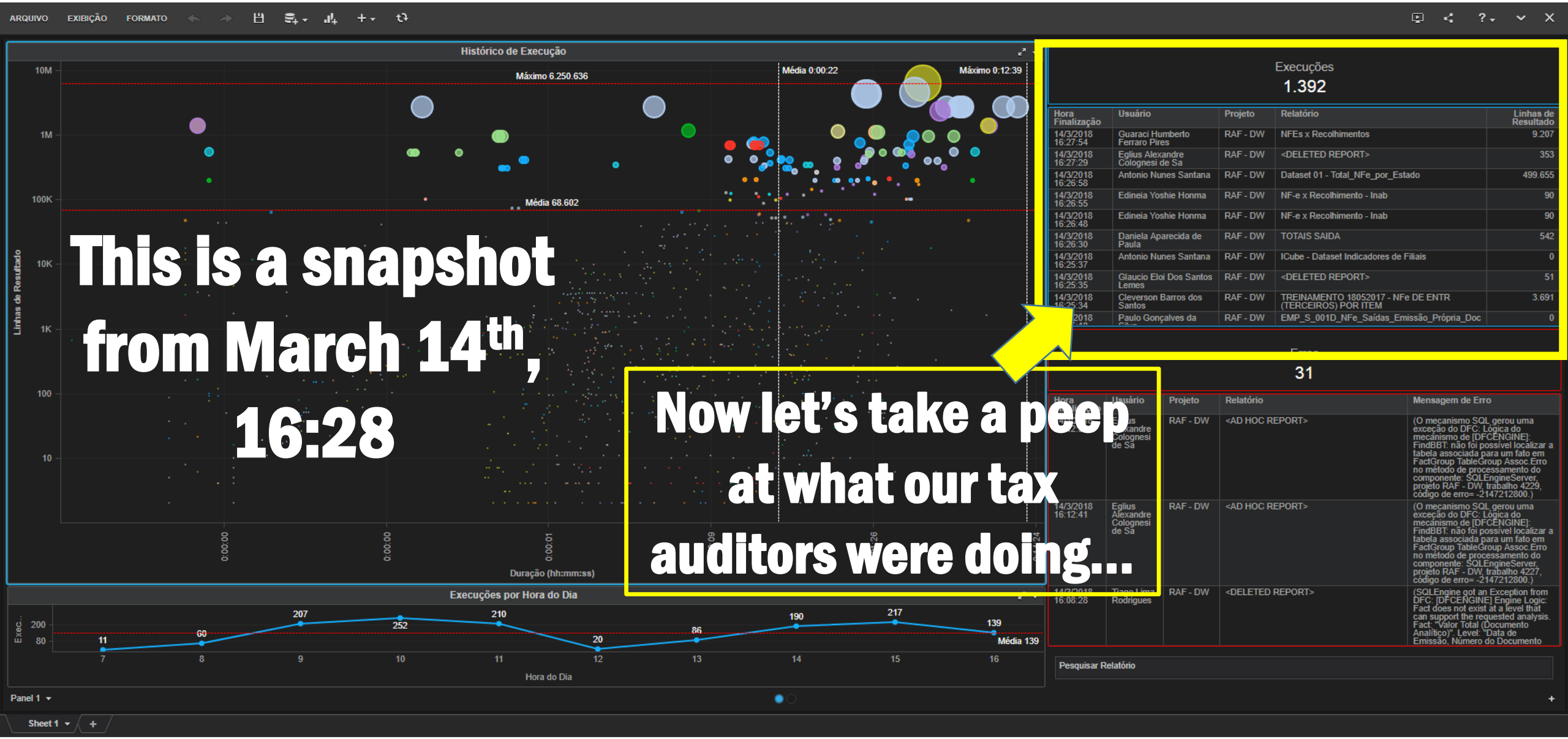


October 27th, 2017: 1,200 report executions

Most reports take just a few seconds to run, with result sets that range from a few rows to tens of thousands

This little fellow took fourteen minutes to run and his result set was *14.2 million* rows

A Typical Reporting Day



This is a snapshot from March 14th, 16:28

Now let's take a peep at what our tax auditors were doing...

A Typical Reporting Day

Execuções

1.392

Hora Finalização	Usuário	Projeto	Relatório	Linhas de Resultado
14/3/2018 16:27:54	Guaraci Humberto Ferraro Pires	RAF - DW	NFEs x Recolhimentos	9.207
14/3/2018 16:27:29	Eglius Alexandre Colognesi de Sa	RAF - DW	<DELETED REPORT>	353
14/3/2018 16:26:58	Antonio Nunes Santana	RAF - DW	Dataset 01 - Total_NFe_por_Estado	499.655
14/3/2018 16:26:55	Edineia Yoshie Honma	RAF - DW	NF-e x Recolhimento - Inab	90
14/3/2018 16:26:48	Edineia Yoshie Honma	RAF - DW	NF-e x Recolhimento - Inab	90
14/3/2018 16:26:30	Daniela Aparecida de Paula	RAF - DW	TOTAIS SAIDA	542
14/3/2018 16:25:37	Antonio Nunes Santana	RAF - DW	ICube - Dataset Indicadores de Filiais	0
14/3/2018 16:25:35	Glaucio Eloi Dos Santos Lemes	RAF - DW	<DELETED REPORT>	51
14/3/2018 16:25:34	Cleverson Barros dos Santos	RAF - DW	TREINAMENTO 18052017 - NFe DE ENTR (TERCEIROS) POR ITEM	3.691

Guaraci was viewing the invoices (and tax payed) from transactions of a specific taxpayer, since 2013.

A Typical Reporting Day

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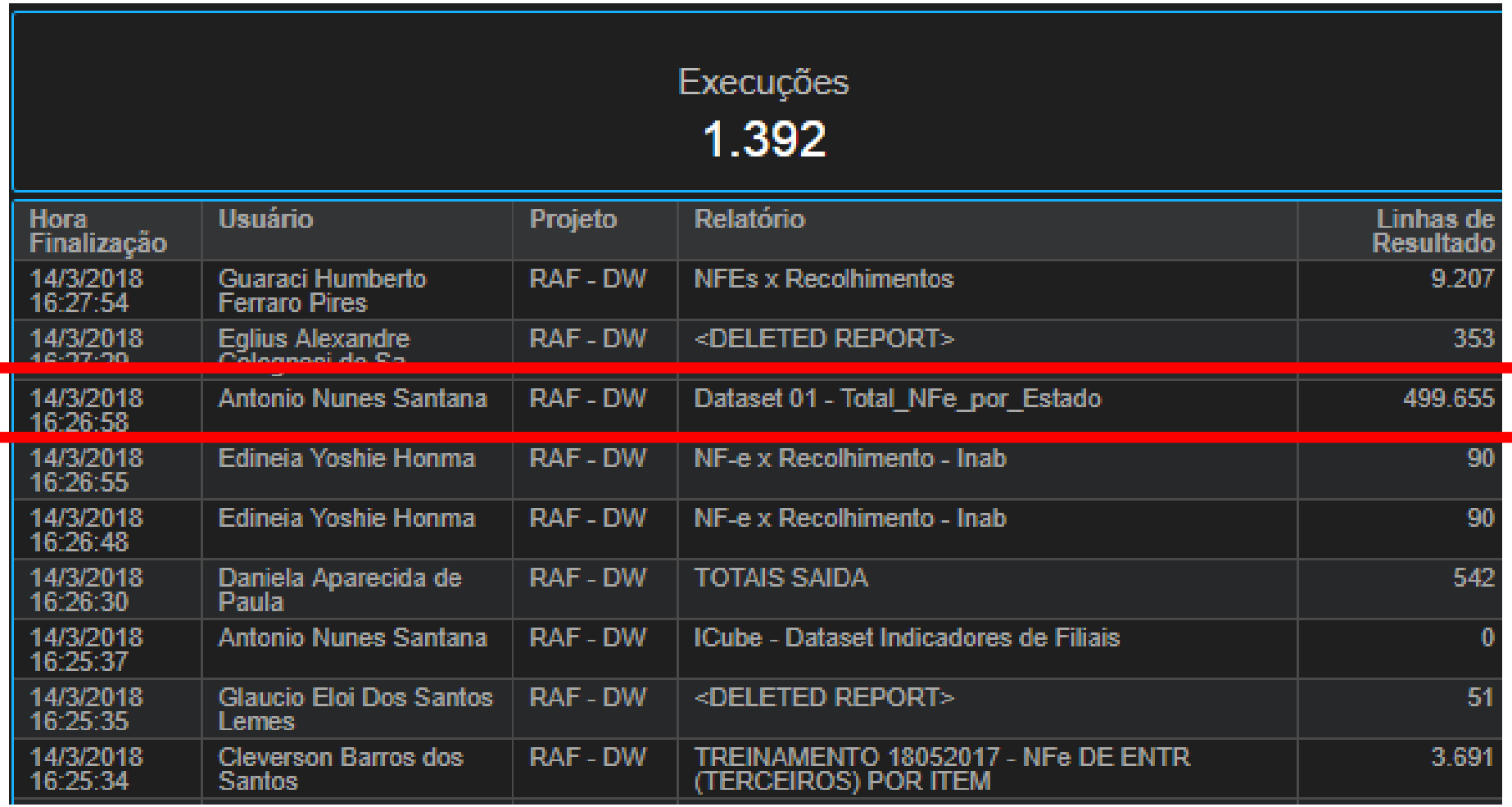
Eglius was viewing the contents informed, by different taxpayers, in texts fields of 325 invoices. Afterwards, he deleted his report.

A Typical Reporting Day



Execuções

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Antonio was browsing an executive dashboard showing total values of all transactions from all taxpayers, by all industries, in the past three years.

A Typical Reporting Day

Execuções

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14/3/2018 16:25:35	Glaucio Eloi Dos Santos Lemes	RAF - DW	<DELETED REPORT>	51
14/3/2018 16:25:34	Cleverson Barros dos Santos	RAF - DW	TREINAMENTO 18052017 - NFe DE ENTR (TERCEIROS) POR ITEM	3.691

Edineia was, like Guaraci, viewing the invoices (and tax payed) from transactions of a specific taxpayer. She ran the same report twice.

A Typical Reporting Day

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14/3/2018 16:26:48	Edineia Yoshie Honma	RAF - DW	NF-e x Recolhimento - Inab	90
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14/3/2018 16:25:35	Glaucio Eloi Dos Santos Lemes	RAF - DW	<DELETED REPORT>	51
14/3/2018 16:25:34	Cleverson Barros dos Santos	RAF - DW	TREINAMENTO 18052017 - NFe DE ENTR (TERCEIROS) POR ITEM	3.691

Daniela was listing the total values (transaction, taxable basis, tax value, freight) of all sales from a specific taxpayer in 2016.

A Typical Reporting Day

Execuções

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14/3/2018 16:27:54	Guaraci Humberto Ferraro Pires	RAF - DW	NFEs x Recolhimentos	9.207
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14/3/2018 16:25:34	Cleverson Barros dos Santos	RAF - DW	TREINAMENTO 18052017 - NFe DE ENTR (TERCEIROS) POR ITEM	3.691

This is a cube (report) part of the dashboard Antonio was browsing.

A Typical Reporting Day

Execuções

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Glaucio was listing all items sold with tax value greater than zero by a specific taxpayer, since 2013. Afterwards, he deleted his report.

A Typical Reporting Day

Execuções

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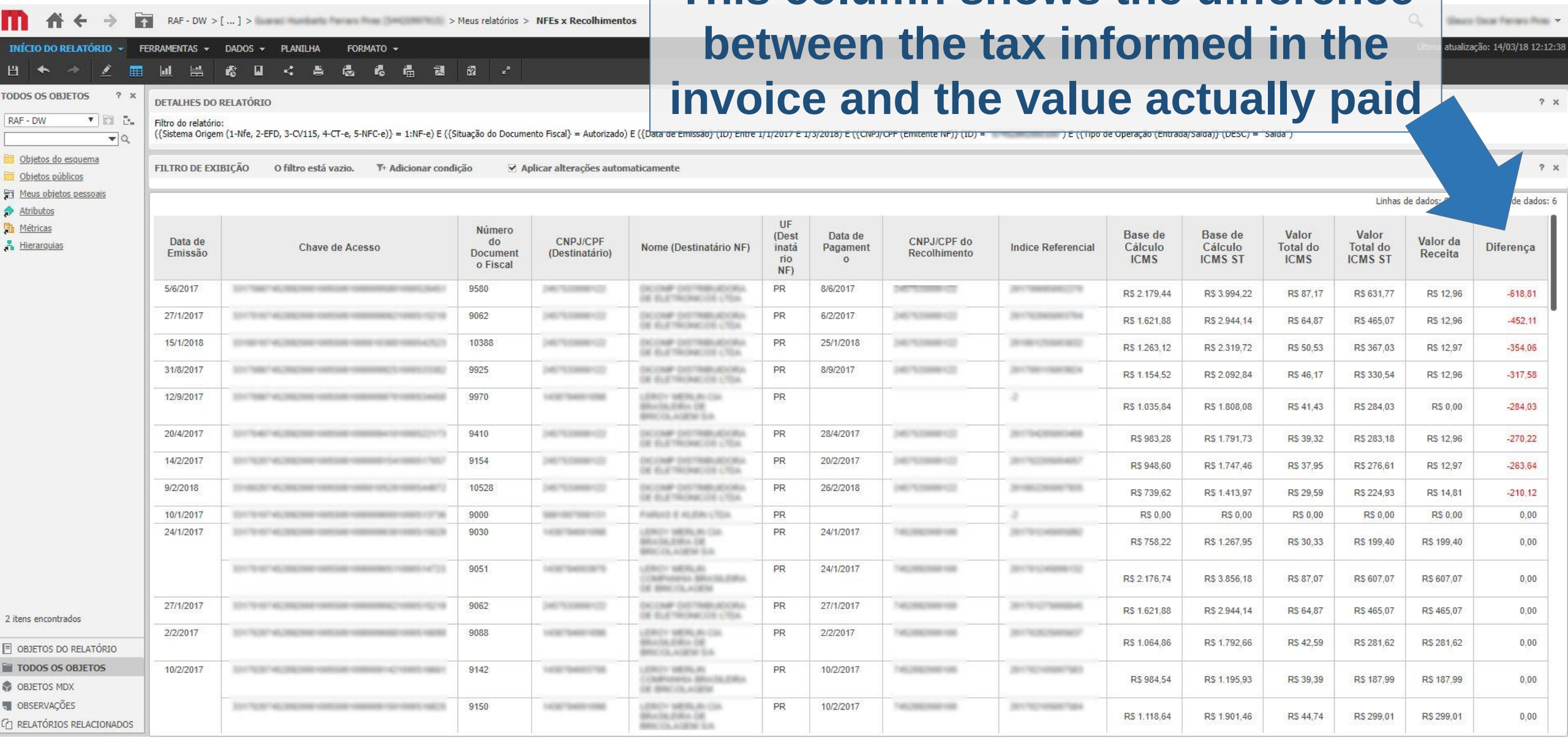
Cleverson was listing every item purchased by a specific taxpayer from 2015 to 2017.

An Example of a MicroStrategy Report Listing All Invoices and Payments and their Difference (Unpaid Tax)

This column shows the difference between the tax informed in the invoice and the value actually paid

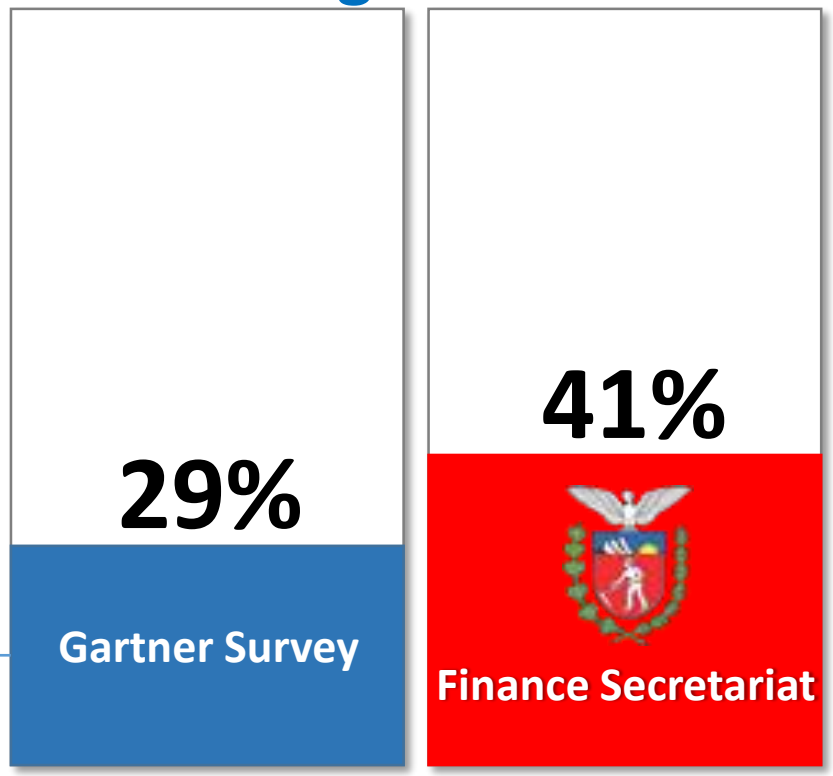


Data de Emissão	Chave de Acesso	Número do Documento Fiscal	CNPJ/CPF (Destinatário)	Nome (Destinatário NF)	UF (Destinatário NF)	Data de Pagamento	CNPJ/CPF do Recolhimento	Indice Referencial	Base de Cálculo ICMS	Base de Cálculo ICMS ST	Valor Total do ICMS	Valor Total do ICMS ST	Valor da Receita	Diferença
5/6/2017		9580			PR	8/6/2017			R$ 2.179,44	R$ 3.994,22	R$ 87,17	R$ 631,77	R$ 12,96	-618,81
27/1/2017		9062			PR	6/2/2017			R$ 1.621,88	R$ 2.944,14	R$ 64,87	R$ 465,07	R$ 12,96	-452,11
15/1/2018		10388			PR	25/1/2018			R$ 1.263,12	R$ 2.319,72	R$ 50,53	R$ 367,03	R$ 12,97	-354,06
31/8/2017		9925			PR	8/9/2017			R$ 1.154,52	R$ 2.092,84	R$ 46,17	R$ 330,54	R$ 12,96	-317,58
12/9/2017		9970			PR				R$ 1.035,84	R$ 1.808,08	R$ 41,43	R$ 284,03	R$ 0,00	-284,03
20/4/2017		9410			PR	28/4/2017			R$ 983,28	R$ 1.791,73	R$ 39,32	R$ 283,18	R$ 12,96	-270,22
14/2/2017		9154			PR	20/2/2017			R$ 948,60	R$ 1.747,46	R$ 37,95	R$ 276,61	R$ 12,97	-263,64
9/2/2018		10528			PR	26/2/2018			R$ 739,62	R$ 1.413,97	R$ 29,59	R$ 224,93	R$ 14,81	-210,12
10/1/2017		9000			PR				R$ 0,00	R$ 0,00	R$ 0,00	R$ 0,00	R$ 0,00	0,00
24/1/2017		9030			PR	24/1/2017			R$ 758,22	R$ 1.267,95	R$ 30,33	R$ 199,40	R$ 199,40	0,00
		9051			PR	24/1/2017			R$ 2.176,74	R$ 3.856,18	R$ 87,07	R$ 607,07	R$ 607,07	0,00
27/1/2017		9062			PR	27/1/2017			R$ 1.621,88	R$ 2.944,14	R$ 64,87	R$ 465,07	R$ 465,07	0,00
2/2/2017		9088			PR	2/2/2017			R$ 1.064,86	R$ 1.792,66	R$ 42,59	R$ 281,62	R$ 281,62	0,00
10/2/2017		9142			PR	10/2/2017			R$ 984,54	R$ 1.195,93	R$ 39,39	R$ 187,99	R$ 187,99	0,00
		9150			PR	10/2/2017			R$ 1.118,64	R$ 1.901,46	R$ 44,74	R$ 299,01	R$ 299,01	0,00

A Gartner Group survey made in June 2017 showed that "**business intelligence remains elusive, with BI and analytics adoption at about 30% of all employees**"*

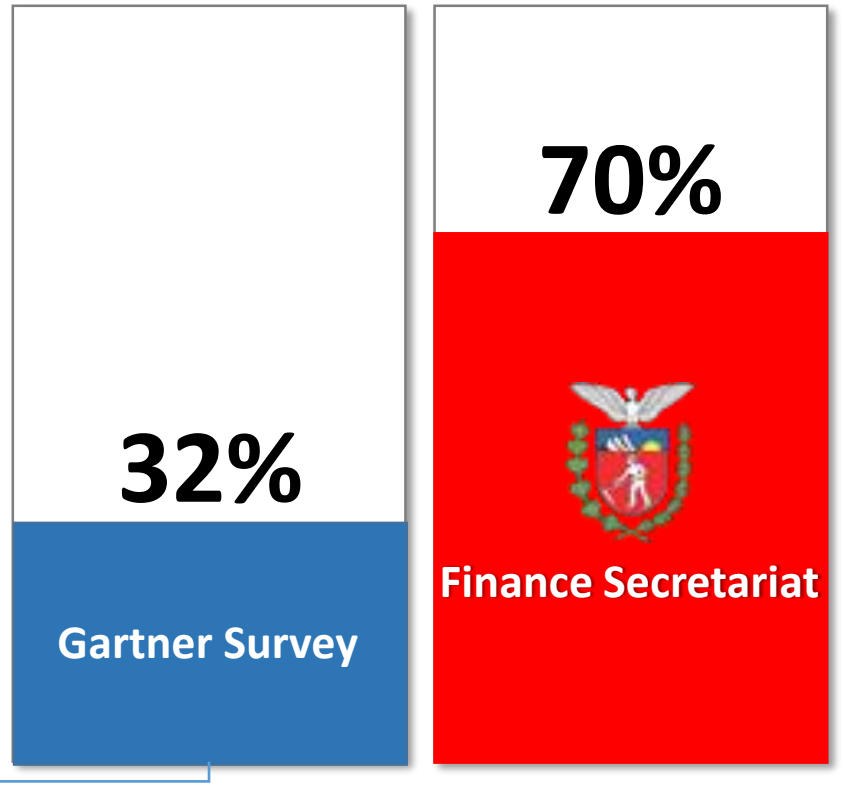
BI Adoption Rate by Size of Organization

"Gartner Survey": results for midsize organization (fewer than 1,000 employees)



BI Adoption Rate by Role

(for role: business user content author & analyst)



* *Source: "Survey Analysis: Why BI and Analytics Adoption Remains Low and How to Expand Its Reach", Gartner Group, published: 30 June 2017*

Chapter Five

Some Solutions & Benefits

Voluntary Disclosure Special Program

Problem

Corporate taxpayers don't always comply with all or part of their tax obligations. But the tax administration doesn't have enough human resources to audit all taxpayers.

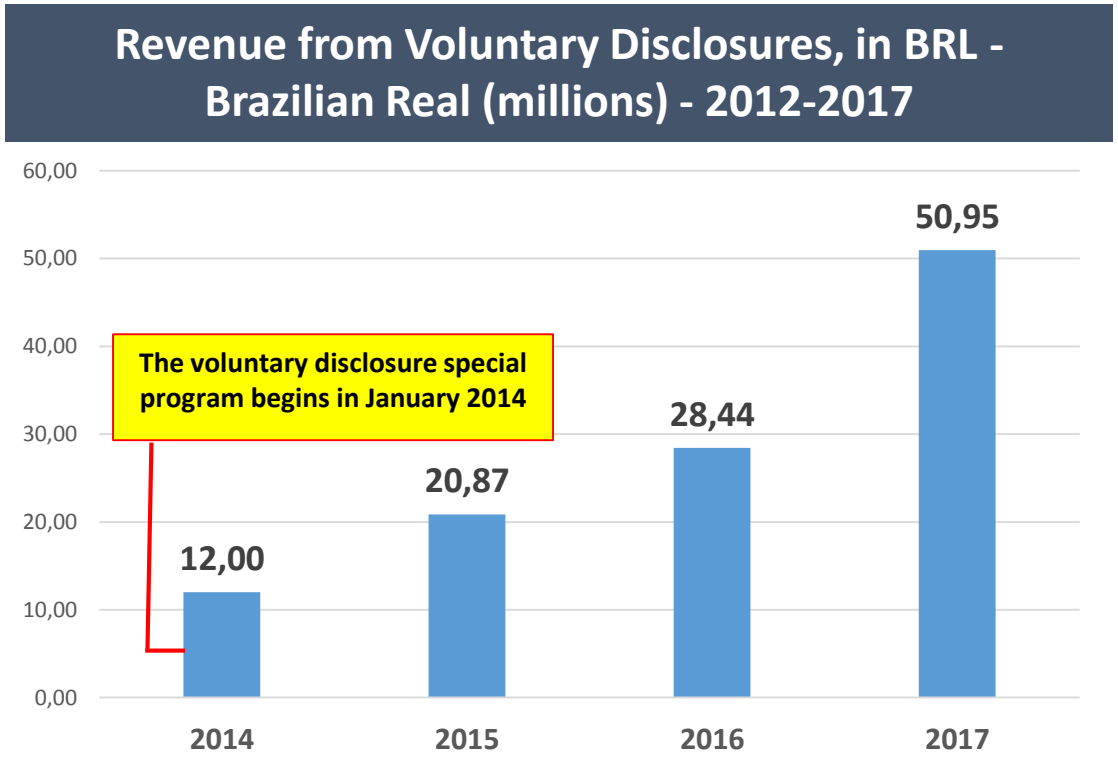
Solution

A special program for voluntary disclosure was implemented. Analytics performed in our Teradata DW, using data from electronic invoices and digital bookkeeping, identifies some non-compliant taxpayers activities. Taxpayers are then informed that a possible tax evasion was detected and they can either file a Notice of Objection (if they disagree with the assessment) or pay the tax evaded.

Benefits

This special program recovers a considerable amount of revenue, increasing year by year. Amount of tax revenue recovered so far:

120 million reais (37 million USD)



Persistent Debtor Program

Problem

Many corporate taxpayers have an established history of default (failure to pay the taxes owed) and it is very time consuming for the tax administration to track and collect taxes from these *persistent debtors*.

Solution

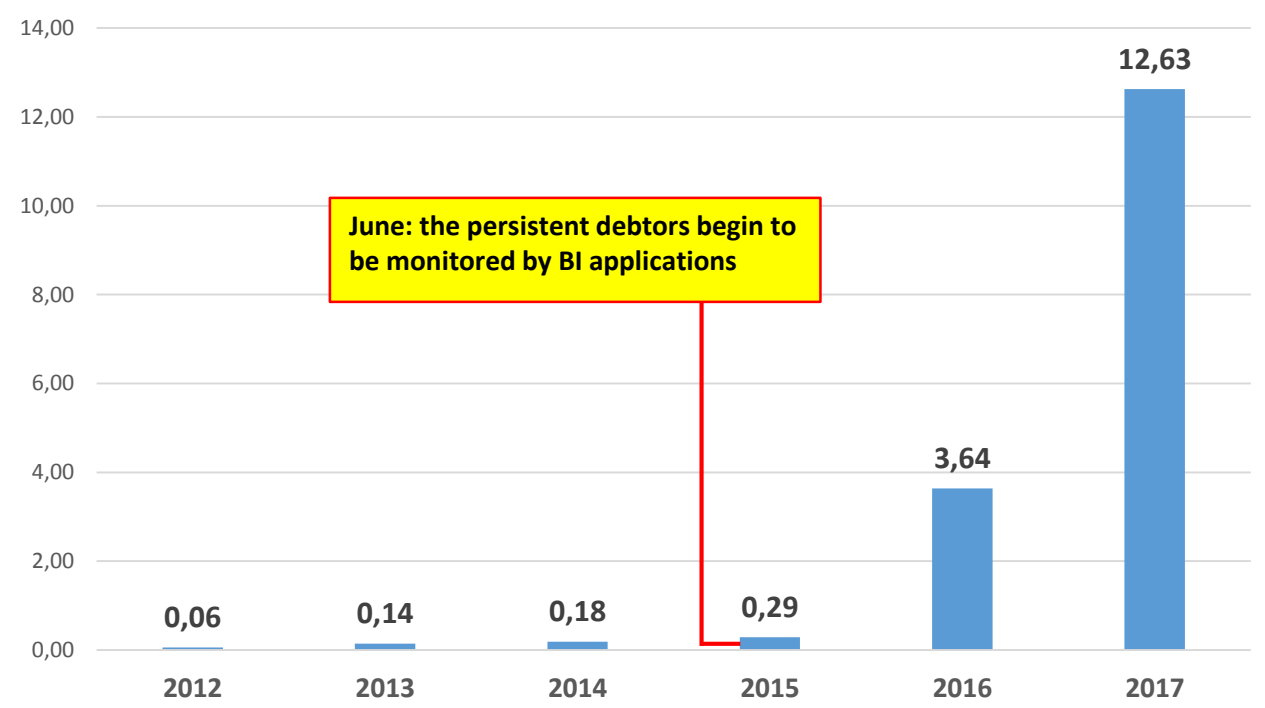
The persistent tax debtors are required to pay their taxes in a daily basis, or after each transaction. So they are constantly monitored and a dashboard identifying all large persistent debtors is used to quickly deploy teams of tax auditors to keep contact with the taxpayer and ensure that they pay their taxes.

Benefits

Tax revenues from persistent debtors increased substantially. Amount of tax revenue recovered so far:

20 million reais (6 million USD)

Revenue from Persistent Debtors, in BRL - Brazilian Real (millions) - 2012-2017



One Small Example of One Simple Tax Audit by a "Not Very Tech Savvy" Tax Auditor… i.e., a Common Guy!

Problem

Corporate taxpayers are increasingly failing to pay the ICMS-ST, the "tax substitution VAT", on their transactions (i.e., failure to declare taxable transactions).

Solution

Using data available in the Teradata DW, the tax auditor built a report in MicroStrategy that compares the taxable value informed by the taxpayer in his electronic invoices with the value of taxes actually paid for each transaction made. Very simple and efficient!

Benefits

This specific tax audit resulted in 10.6 million reais of tax paid by the offending taxpayer.

The MicroStrategy report used for this audit is used by the tax auditor on other taxpayers, simplifying his work and making it far more efficient and rewarding than before.

Only **1** type of tax audit...

...on only **1** corporate taxpayer...

...by only **1** tax auditor...

...recovered

10.6 million reais

(3.3 million USD)

Chapter Six

What Are They Saying?

And what our tax auditors are saying about our new analytical toys?

Efficiency & Completeness

"Now we can perform tax audits with much more in-depth analysis and in less total time"

Volume

"... is extremely important for tax enforcement, especially regarding corporate taxpayers with large volumes of data"

Easy of Use

"The simplicity is scary, it's difficult to believe in how easy this is"

Accessibility

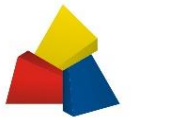
"We finally have quick access to data and information"

Availability

"The sky is the limit to how we can work with the available data"

Speed

"It allows quick analysis of inconsistencies in taxpayers data"



Analytics in the Age of Electronic Invoicing and Digital Bookkeeping

Thank You!