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Performance Challenges in a Mainframe System

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People matter, results count.

Agenda

- Business Context and Objectives
- The Solution‘s Big Picture
- Sources of Performance Data
- Data Aggregation and Mapping of Initiator Classes
- Reports

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- **Business Context and Objectives**
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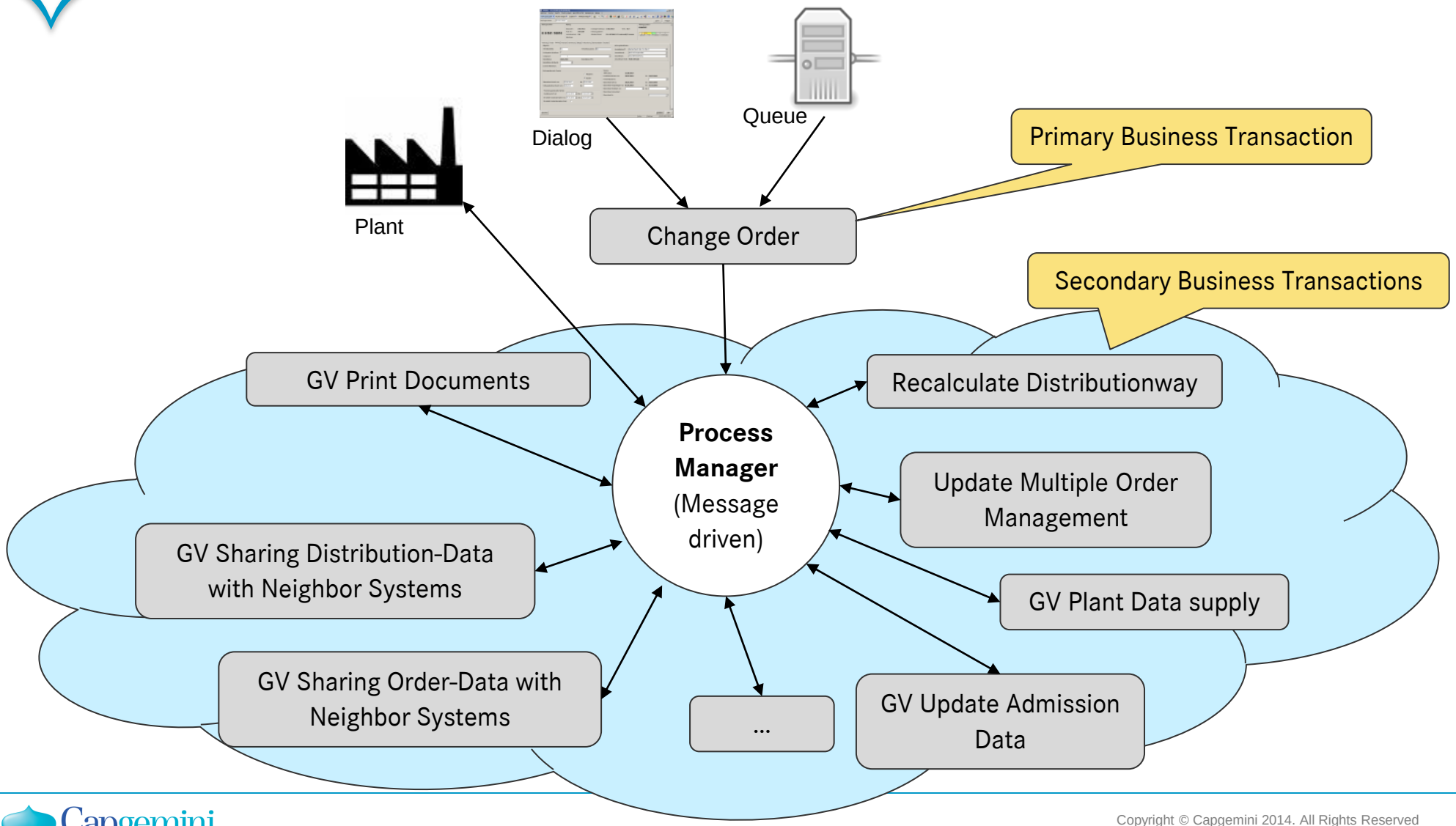
Business Context

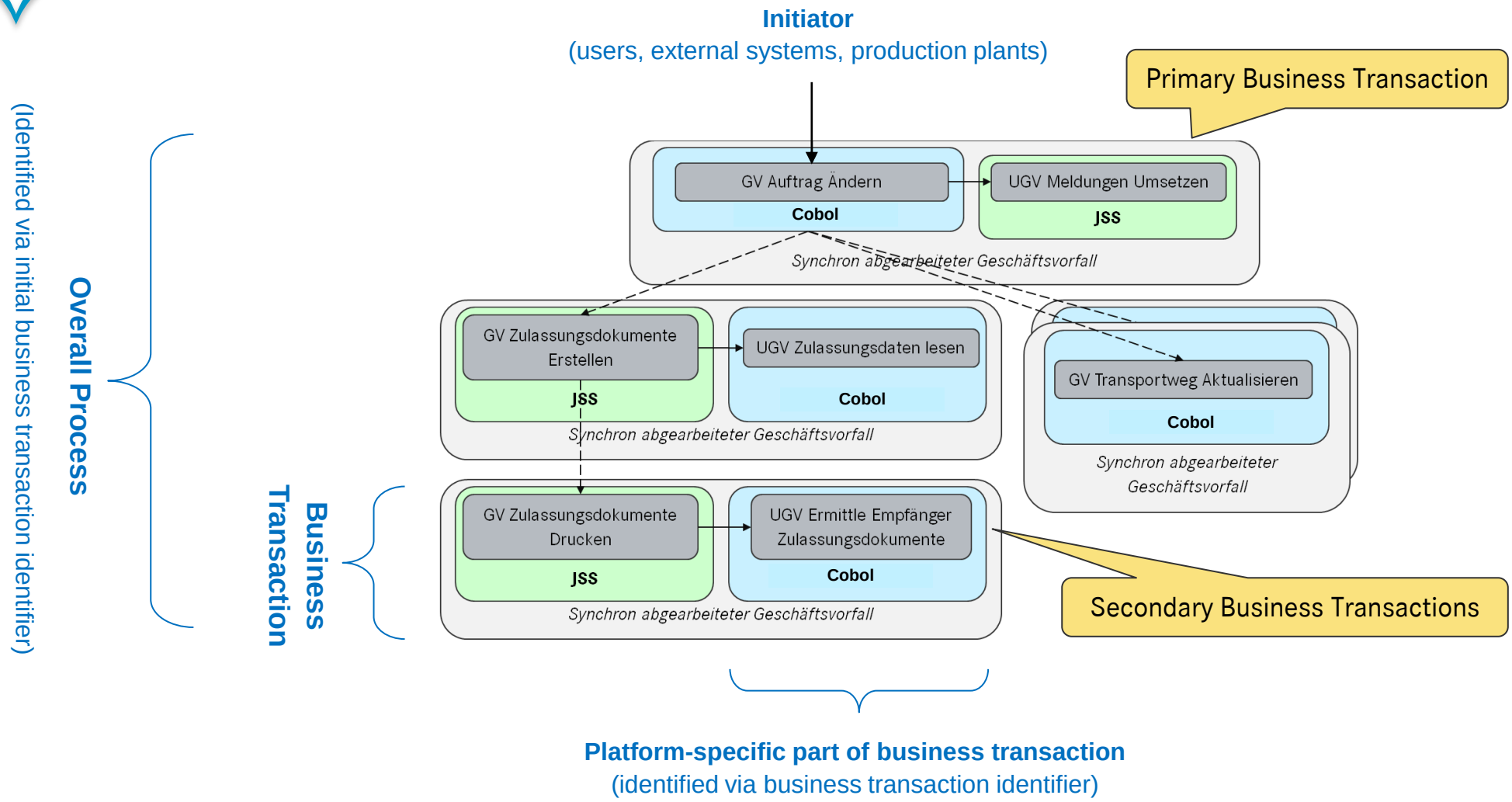
- The ordering system of a car manufacturer processes several hundred thousand car orders each year.
- It is used by thousands of dialog-users at car-dealerships, market systems, production plants and several other third party systems
- The system is running on an IBM mainframe and uses several technology stacks such as
  - CICS/Cobol
  - Websphere Application Server/Java
  - Messaging (Event Based System)
  - IBM DB2
- Many other applications are running concurrently on the same mainframe
- The ordering system is subject to a constant change and growth due to
  - enhanced/new functionalities
  - the addition of new markets and market systems
  - rise in car sales and/or the increasing complexity of the cars themselves.

Challenge: Performance Management

Business Context – Application Structure



Business Context – Business Transactions View



Business Objectives

- **The general questions to be answered are:**
  - Who is calling which business transaction and how much cpu-time is consumed?
  - How expensive is a business transaction?
  - How can the cpu-consumption of secondary transactions be evaluated in an event based system and how can it be attributed to user-classes and/or business transactions?
  - Which technology (i.e. CICS/Cobol or WAS/Java) causes the growth? Where are the cost drivers?
  - How large is the future cpu-consumption in the context of a forecast for the predicted growth in car sales and additional functionality due to new releases.

- **Our Solutions:**
  - Classification of users, external systems and production plants into "Initiator classes" for cost allocation
  - Classification of business transactions into "Process classes" for consumption analysis
  - Introduction of a "process ID" to attribute Secondary cost to the initial business transaction (Primary cost) and to "follow" the overall process cost in a message based system

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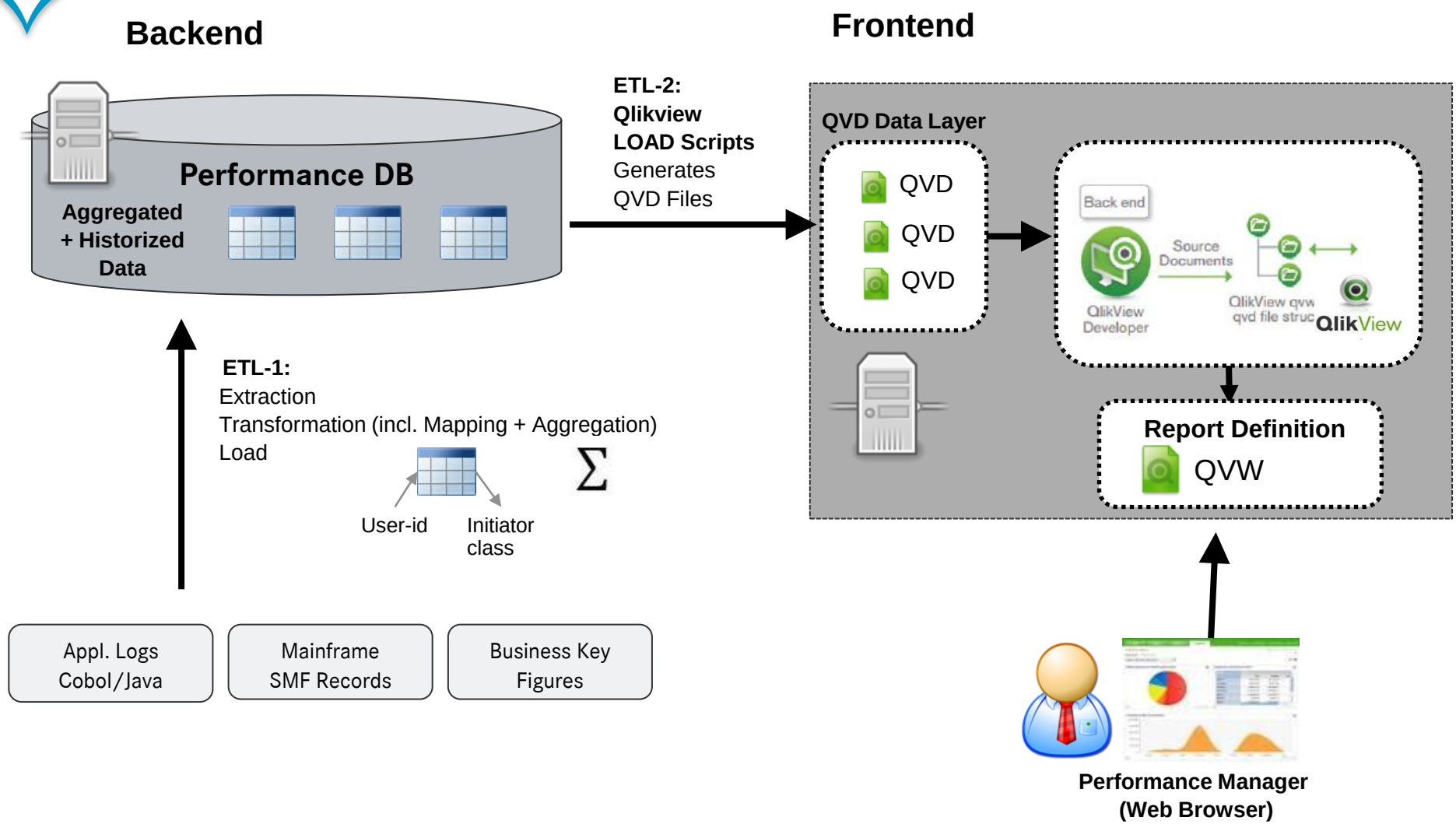
The Solution‘s Big Picture



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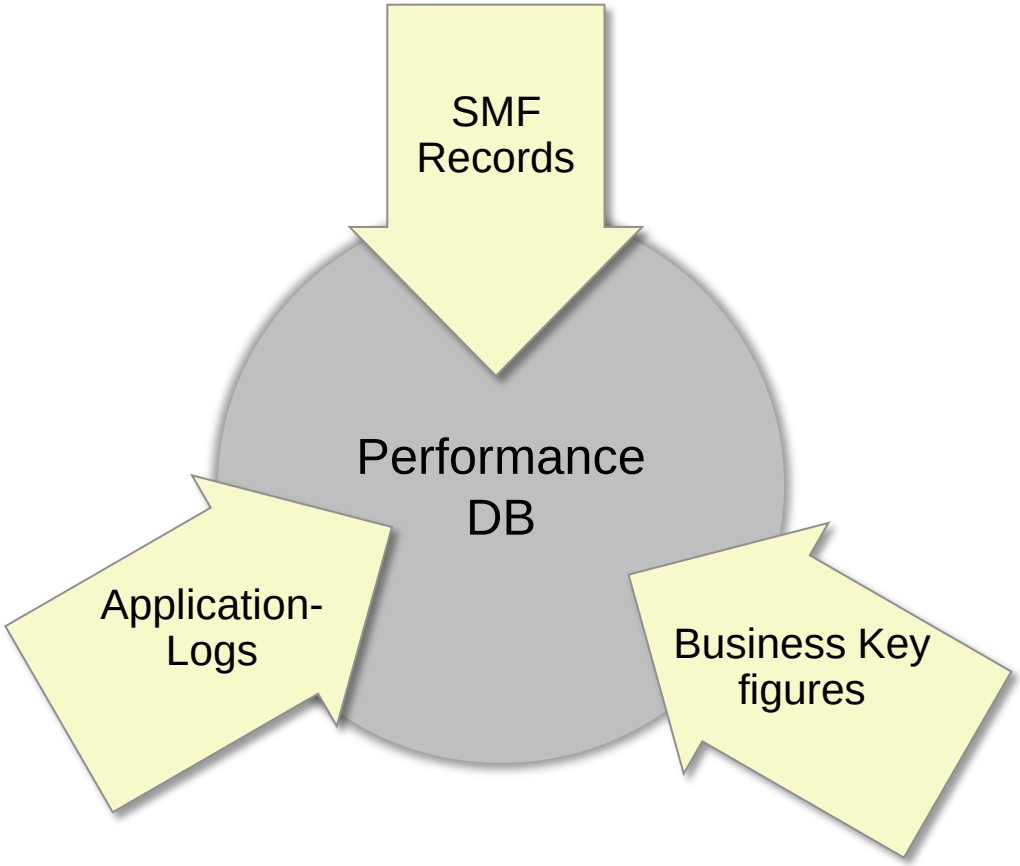
Sources for Performance Data



- **SMF Records**
  - CPU-Consumption
- **Application Logs**
  - Business Transactions with runtimes
  - Business Transaction call count
- **Business Key Figures**
  - Car sales…

Challenge:

How to link Application runtimes to SMF CPU-Consumption ?

Mainframe System Management Facility (SMF) Records

IBM System Management Facility (SMF) - Definition[1]:
SMF is a component of IBM's z/OS for mainframe computers, providing a standardised method for writing out records of activity running on that IBM mainframe operating system to a file (including CPU-costs, I/O, network activity...)

- SMF provides us information on
  - CPU-Consumption of different CICS and EJB transactions
  - Which type of CPU was used (CP, zIIP, …)

- There are different Types of SMF Records
  - SMF 30 - General Job Information
  - SMF 110 - CICS
  - SMF 120.9 - Java
  - …

- SMF Records can be "enriched" with application specific data (i.e. user-ids, current business transaction identifier)

- Example SMF Record

CICS	CICS-Transaction	Timestamp	User	Business Transaction ID	nCPUmin
CICS1	SABCD	15.09.2014 13:07:34	ZUSR1	GV1	3

1. Adjusted from http://en.wikipedia.org/wiki/IBM_System_Management_Facilities

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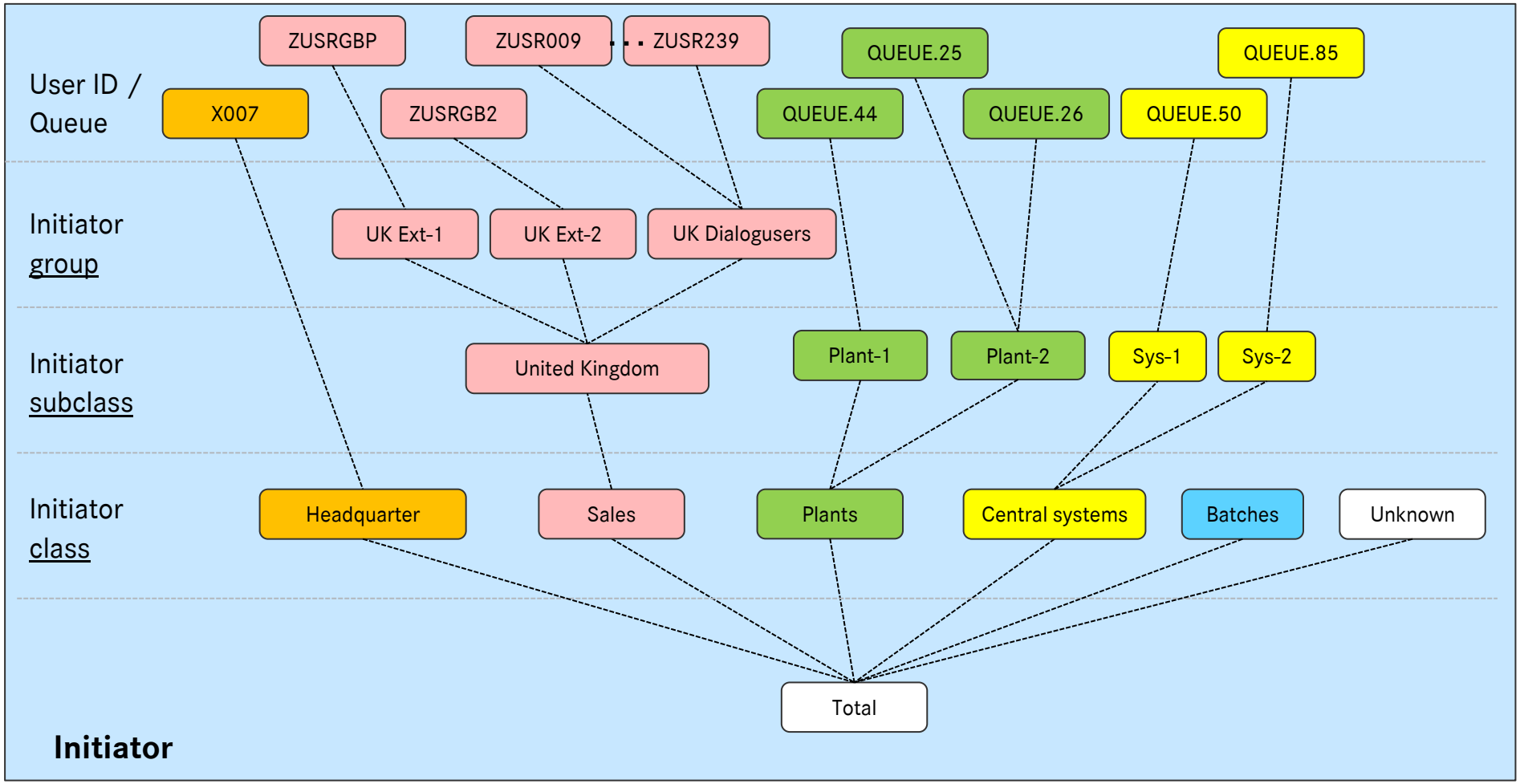
Initiator Classes

Design goals and challenges for the taxonomy of Initiator Classes :

- Protection of data privacy
- Adequate grouping of users in different classes
- Identification of external systems
  - via their technical users
  - via queue names
- Achieve a best fit between the granularity of data vs the cost of storage
- Initiator classes have to serve as a basis to charge-back cpu-cost on a user-class basis
- Taxonomy of Initiator Classes enables drill-functionality in the BI-Reports

Initiator Classes Taxonomy



Aggregation and mapping of initiator classes for application log records

Log entry in application log

CICS Name	CICS Transaction	Initial User	Initial Bus. Transaction	Zeit-stempel	User	Business Transaction	Runtime
CICS3	S07ABC	**ZUSRGB2**	**XVABAACV**	05.08.2014 12:03:01	ZUSRGB2	**XVABAACV**	60 ms

Hourly Aggregation and Mapping of Initiator classes for the Performance Database

Aggregated record

CICS Name	CICS Transaction	Initiator Class	Initial Bus. Transaction	Hour	Business Transaction	Call count	Overall Runtime
CICS3	S07ABC	**UK Ext-2**	**XVABAACV**	05.08.2014 12:00	**XVABAACV**	1120	50000 ms

Splitting of large SMF Records of secondary transactions

- Secondary business transactions are processed asynchronously by workers sitting on queues
- Worker takes message out of queue and starts business transaction in CICS transaction
- CICS writes only a few large SMF records per CICS transaction (for many different business transactions)
- The large SMF records for each CICS Transaction are aggregated daily

SMF Record for Secondary Business Transaction (daily aggregated)

CICS Name	CICS TRANSACTION	Date	Calls	nCPUmin
CICS1	ABC01	05.08.2014	47	2.410

Can contain several secondary business transactions, each of them called many times

- Runtimes for each secondary business transactions are aggregated from application logs
- Large SMF records are split up proportionally using runtimes for each secondary business transaction
- This approach does not provide exact CPU usage for secondary business transactions, but a first approximation

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Example Report Mockup - CPU-Consumption

Report 2.a:

- + Headquarter
- - Sales
  - + Germany
  - + China
  - - UK
    - Access System 1
    - Access System 2
    - Dialoguser
- + Plants
- …

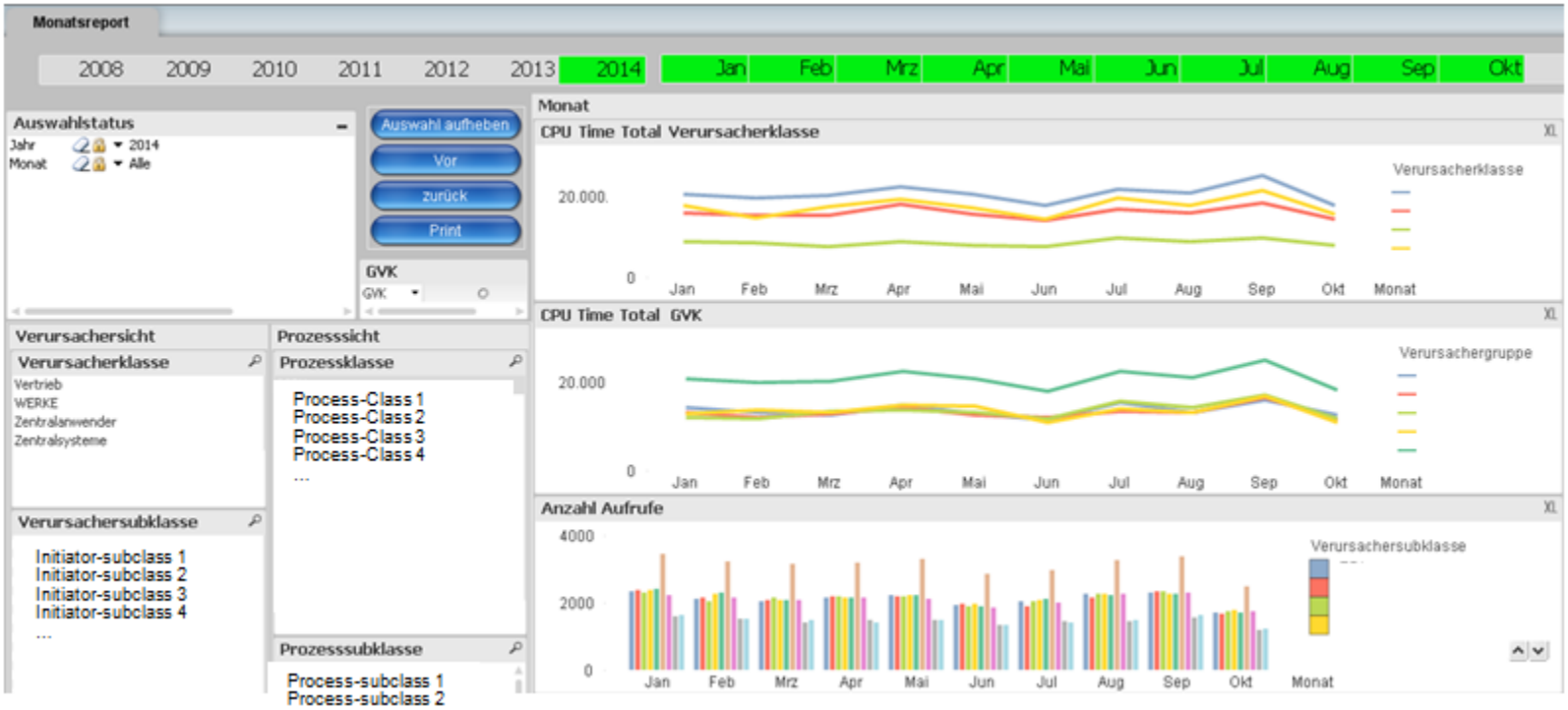
Example Report-Mockup showing Drill-functionality

- Drill by Initiator-Class and -Subclass
- Drill by Access

- Sales		Jan 2014		Feb 2014		…		Dez 2014		Total	Average	StDev
+ Germany												
+ China												
- UK												
	Access System 1	426.324	10,72%	403.327	-5,39%	413.900	2,62%	354.588	-14,33%	1.598.139	266.356	207.748
	Access System 1	634.234	9,88%	893.455	40,87%	983.432	10,07%	1.023.210	4,04%	3.534.332	589.055	475.961
	Dialog-Users	235.433	2,31%	345.287	46,66%	432.678	25,31%	659.123	52,34%	1.672.522	278.754	256.937
	Total	1.295.991	x	1.642.069	26,70%	1.830.010	11,45%	2.036.921	11,31%			
+ Plants …												

* Randomized Data

Reports in Qlikview



Drill-Functionality

- By Initiator-Class/-subclass
- By Process-Class/-subclass

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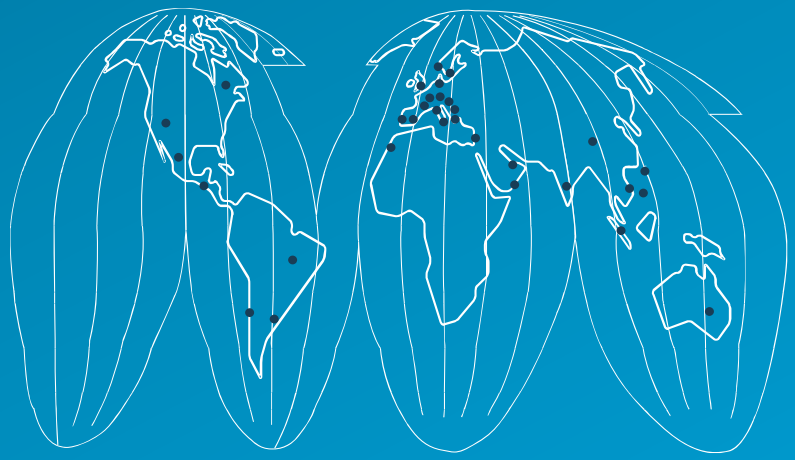

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