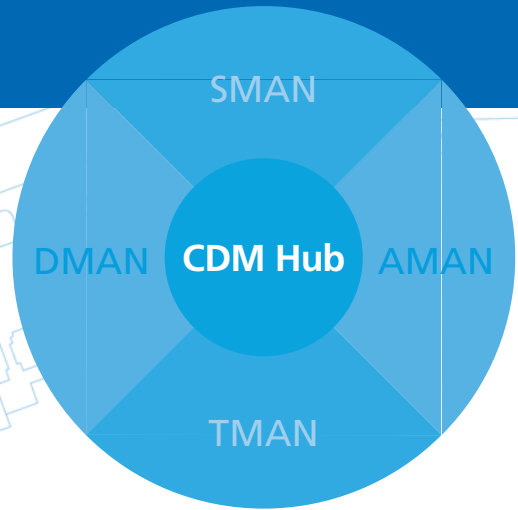


CDM Hub | Integration of Standards



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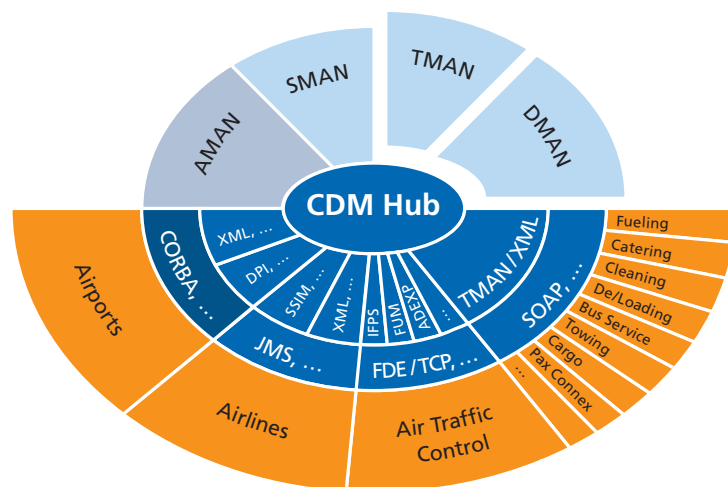
The Challenge

The concept of Collaborative Decision Making as a seamless interplay between air traffic control, airport, and airline creates a challenge to the IT-technique of all participants. On the one hand standard solutions approved in the market shall be applied, on the other hand these standards are to be integrated into the customer-specific IT-landscape.

The Solution

The CDM Hub offers a one-stop solution to these challenges.

Overview CDM Hub



On the one hand the CDM Hub represents an application platform for the components relevant to CDM (for details please refer to the leaflets enclosed):

- AMAN (Arrival Management) by ATRiCS
- SMAN (Surface Management) by ATRiCS
- TMAN (Turnaround Management) by Informationsdesign
- DMAN (Departure Management) by ATRiCS

On the other hand the CDM Hub offers a wide range of communication protocols and data formats frequently employed in the aviation market. The underlying Data Hub technology applied by Informationsdesign has been successfully tried and tested in the business critical environment of mega airports for more than ten years now.



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CDM Suite

DEQUEST – Departure Management (DMAN)

Coming from different parking areas and due to different pilot preferences, the sequence of aircraft arriving at the departure runways is often randomly mixed up – even if off-block times are managed in a pre-departure sequencing process. After hand-over from ground or apron control, the departure controller has only limited possibilities to optimize the take-off sequence by re-arranging the aircraft waiting in the holding bay.

Using surveillance and flight plan data, DEQUEST continuously plans aircraft sequences at taxiway intersections to establish optimized take-off sequences at the runways. When aircraft are approaching an intersection in a sequence that differs from the planned sequence, DEQUEST offers a sequencing proposal to the controller.

DEQUEST thus increases runway throughput by optimally sequencing flights on their way to their holding-positions and improves adherence to ATFM slots, to hold-over times and other time constraints. Taxi times, fuel consumption and pollution are minimized. Finally, controller workload is reduced by minimizing the necessity to re-arrange aircraft in the holding bays.

ASCAPE – Arrival Management (DMAN)

Pre-tactical flow management by means of ground delays cannot prevent inbound demand from exceeding the available arrival capacity of an airport. Approach controllers still have to apply path stretching procedures and holdings to establish a safe and orderly flow of traffic. The gap between pre-tactical flow management and operational air traffic control thus urgently needs to be closed.

Based on flight update messages, ASCAPE sends an ETA request via data link to the cockpit as soon as an inbound flight is expected less than 120 minutes out. An FMS-download then provides ASCAPE with the most accurate ETA available. ASCAPE computes an optimized arrival scenario that meets the given arrival rate and maximizes throughput and punctuality at the runways. Each flight is assigned a required time of arrival (RTA) to be met by applying a speed change of less than $\pm 5\%$. The RTA is then uploaded to the flight deck and can be accepted or rejected by the flight crew. If accepted, the RTA functionality of the on-board FMS can be used to automatically meet that time.

Using ASCAPE, the available airport capacity is utilized in the best possible way by tactically adjusting inbound demand. Controller workload is reduced delivering a smooth and coordinated flow of traffic while at the same time, flight efficiency is improved by avoiding flight path stretching and holdings

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Turnaround Management (TMAN)

Turnaround Management is monitoring airside and landside ground processes inside the turnaround time window (for example de-boarding, catering, cleaning, fueling or towing). The objective is the coordination of all participants based on a contractual target time rule set.

The information platform TMAN offers a big portfolio of functions: connecting the participants, monitoring the current processes and passenger flows, reporting the key performance indicators, offering multi-dimensional analysis up to the details, calculating incentives/penalties based on contractual models and much more.

TMAN is used successfully since 2002 by Deutsche Lufthansa in the mission critical environment of Frankfurt and Munich hub airports as part of the project ALLEGRO.

Surface Management (SMAN)

Traffic figures are rising and new traffic management systems are being introduced. Ground movement controllers have to deal with increasing complexity at their working positions. A higher degree of automation is required to manage this complexity and to increase throughput and punctuality even in adverse weather conditions while preserving a high level of safety.

SMAN A-SMGCS comprises a set of advanced controller assistance services. The surveillance service applies mechanisms to eliminate phenomena inherent to sensor systems such as discontinuity or inaccuracy. The conflict service continuously scans the traffic situation for critical or unintended occurrences and provides alerts or warnings. The route service proposes individual taxi routes to controllers on request or for events such as touch-down or route deviation. The guidance service protects runway operations by dynamic stop bar control and guides aircraft along their assigned routes by dynamic taxiway center line light control.

Using SMAN A-SMGCS, situational awareness is improved by automatic detection of critical conflicts. The system reduces the number of conformance failures using airfield ground lighting equipment pro-actively and unambiguously. By automating the monotonous tasks of manually controlling airfield ground lighting, controller workload is reduced.



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Integration

Informationsdesign's Data Hub is a mission critical Enterprise Application Integration (EAI) – and: it is designed specifically for the aviation market.

- **Standards** of the aviation market (SSIM, SSM, ASM, MVT, ..., FUM, DPI, ..., ARINC, ACARS, ...) may be added by means of modules.
- **Rules Engines** cover the integration of ICAO/IATA-worlds, aircraft rotations, crew rotations, passenger connections, the mapping of ground processes, maintenance and much more.
- The **Native Layer** enables the Data Hub to act as a data turntable for the publication of native data formats such as standards (DPI, FUM, ...).
- The **Format Layer** offers a representation of the original data formats in accordance with the transaction rules, based on XML schema.
- The **Integration Layer** brings the best of all worlds together. It derives the most appropriate data at the time from most distinct sources by means of update rules and rules engines configurable.
- **Java-based Clients** provide the quickest possible connection to the CDM Hub.

Migration

Data Hubs are solutions frequently applied in order to migrate heterogeneous IT-landscapes gradually.

- They support modern protocols (Web Services, Java Message Services, IBM MQ Series, ...), but also established (CORBA, ...) as well as classic (X25, DCE/RPC, ...) protocols.
- In addition to that they enable any given TCP/IP-based or X25-based interface.

Configuration

- Filters that may be configured during operation time deliver the requested data meeting quite distinct criteria: airports, airline designator, service types, aircraft types and so on; as well as the choice of entities or attributes.
- Extensive update rules define the sources submitting data of higher quality.

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High Availability

Data Hubs have been successfully standing the test in the particularly business critical environment of airlines, airports, and air traffic control for more than ten years now.

- The **strict modularity** allows for closing a specific component at any time, exchanging it with upgrades and restarting it, while the operation of the remaining Data Hub continues unaffectedly.
- **Configuration** may take place during processing time, restarts of certain modules are the exception.
- **Cluster** solutions – the market leaders – are supported.

Performance

- The internal data process is **constantly driven by event**, without polling, and up to the external system, providing the interfaces (Push Services) enable it.
- The **core components and services** are implemented in C++, additional services in Java.

Quality Assurance

Since the IT-process centres around EAI, extensions of interfaces and rules engines have become everyday business already. For that reason the Data Hubs are optimized with respect to quality assurance operations enabling a high release frequency as well as high availability.

- **Online-replicated test systems** provide tests in close vicinity to production.
- The architecture is **optimized with respect to test procedures**, covering a range from module tests up to integration tests, performance tests and regression tests which detect adaption mistakes quickly and thoroughly.

Operation

- **Scalability** enables small scale, decentralized installations up to cluster-based, centric solutions.
- Is the **operation run by company-owned departments or by third parties?** That makes no difference, owing to tools with integrated manuals including check lists and actions.
- An optimized logging facilitates **full tracking** of all business cases and data streams; that way all the errors, wrong deliveries, or misunderstandings can be traced and cleared up in a revision-proof manner.



Data Hub Technology

Architecture

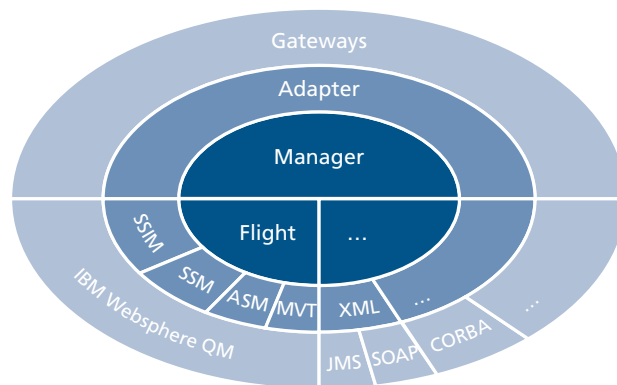
The CDM Hub is based on the Data Hub technology from Informationsdesign. It follows the path of Enterprise Application Integration (EAI): a central system collects the data, integrates them with a consistent data stock, builds the rule sets upon that stock and finally supplies these data via standardized interfaces to other systems.

Most EAI systems however feature little more than the contemporary communication standards (web services, IBM MQ Series, SAP, CORBA, ...) and are mostly relying on XML based data formats. The legacy systems are left out or connected only with great effort.

Thus the Data Hub technology of Informationsdesign takes a consequential route: following a distinct specialization on the aviation market all the vital standard data formats and rule sets (ICAO, IATA, ...) of the industry exist in the data hub off-the-shelf. Likewise, all prevalent communication protocols are supported, from the up-to-date protocols back to the standards of the 1980s. Last, but not least any kind of proprietary interface can be added.

A Data Hub combines three types of modules which are laid out in three circles:

Architecture of a Data Hub



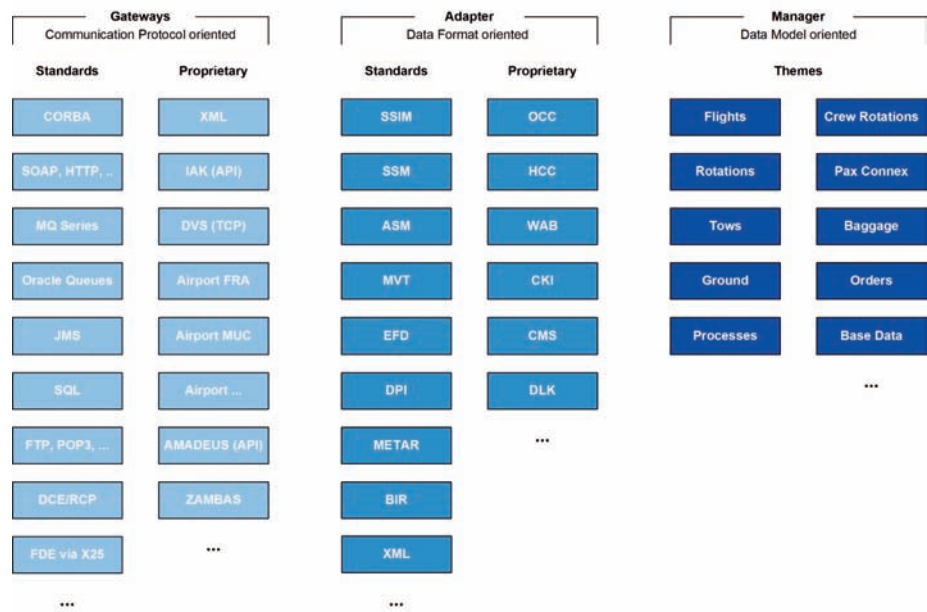
- Gateways map the communication protocols – independent from the transported data
- Adapters transform the proprietary data formats of external systems to a uniform XML-based format (and back again).
- Managers host the rule sets for integration, business logic, enrichment and filtering of the data.

All modules are coupled by persistent queues combined via configuration.

Components

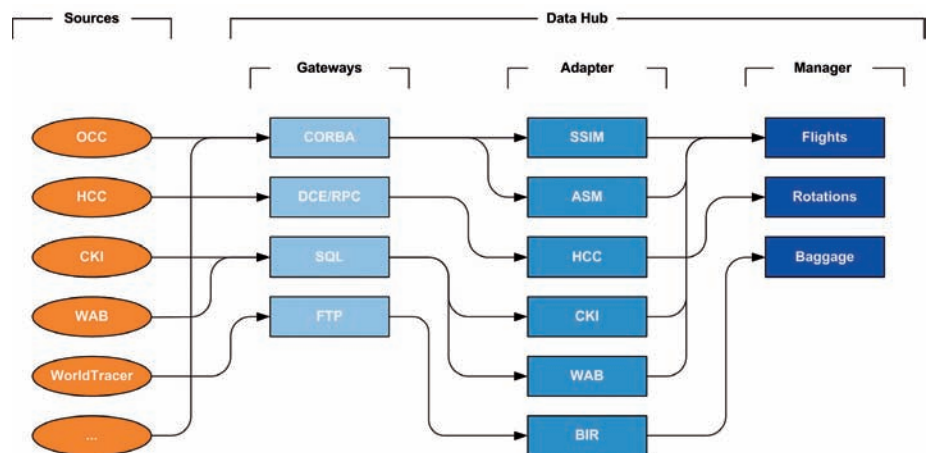
Below you will find selected components, which ...

Selected components



... can easily be put together into a Data Hub.

Combined Data Hub





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Gateways (Excerpt)

Protocols	Notes
IBM Websphere MQ	For enterprise messaging/queuing solutions
Java Messaging Services	For enterprise messaging/queuing solutions
CORBA	Based on defined IDLs
SOAP	SOAP as a Web Services standard
HTTP / HTTPS	Stateless request / reply transfers
FTP	Regular transferring files to/from a remote FTP server
FILE	Cyclic monitoring of changes on a file system in order to pick-up new and modified files
SMTP / POP3	Mail notifications cetera. Also for SMTP-bridges for Telex and Fax deliveries
XML	In the sense of TCP/IP or other protocols for which an XML schema is defined
SQL	Plain Oracle SQL*Net and others, using transfer tables
Oracle Advanced Queues/Streams	Used for tight interprocess communication with a database centered application
DCE / RPC	Unix close TCP/IP based, mainly used in Air Traffic Control
FDE / X25	Also mainly used in Air Traffic Control, based on X25 lines
FDE / TCP	Also mainly used in Air Traffic Control, based on TCP/IP
SCP	Secure copy using underlying SSH (secure shell) protocol

Adapter (Excerpt)

Data Formats	Notes	Context
SSIM	IATA Standard Schedule plan format	IATA
SSM	IATA Standard Schedule Message format	IATA
ASM	IATA Adhoc Schedule Message format	IATA
MVT	IATA ground (AHM 780)	IATA
PTM	Passenger Transfer Message	IATA
IFPS	Integrated Initial Flight Plan Processing System	CFMU
EFD	ETFMS Flight Data	CFMU
DPI	Departure Planning Information	CFMU
FUM	Flight Update Message	CFMU
METAR	Weather data (actuals, forecasts)	DWD
BIR	Baggage Irregularity Repository (World Tracer)	SITA
SAMS	Services of airport coordination	IATA/ICAO
IFPS	IFPS Message	CFMU
ATFM	ATFM Notification Message (SAM, SLC, FLS, ...)	CFMU

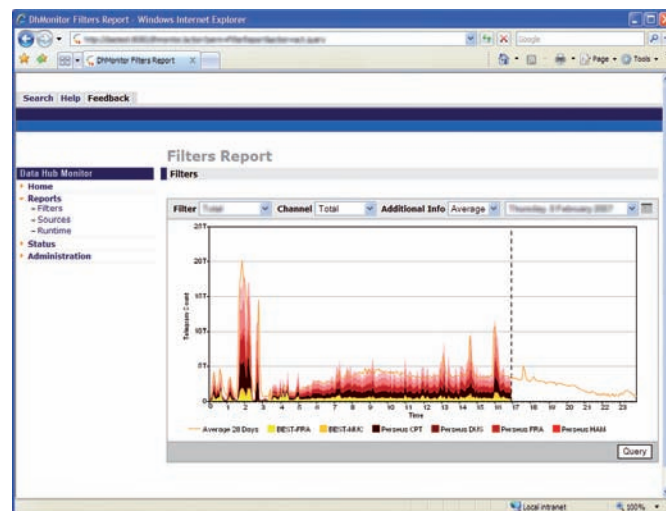
Manager (Excerpt)

Data Models	Notes
Flights	Flights, segments , legs, movements
Aircraft Rotations	
Crew Rotations	Rotations, shifts, ...
Passenger Connex	
Baggage Transfer	Baggage routing, lost&found, ...
Ground Traffic	Airside and landside processes
Tows	
Orders	Order for towing, ground process, ...
Routings	Waypoints, ...
Airspaces	

Tools

The Data Hub has a web-based surface for monitoring, configuration and system administration, and it also includes an elaborated role concept.

Snapshot of Data Hub



Technologies

Informationsdesign uses state of the art technologies:

- SunSoft Solaris, HP-UX, IBM AIX, Linux
- Oracle Database
- BEA WebLogic, JBoss, Java 2 Platform
- Messaging-, Distributed-System und Queuing Technologies

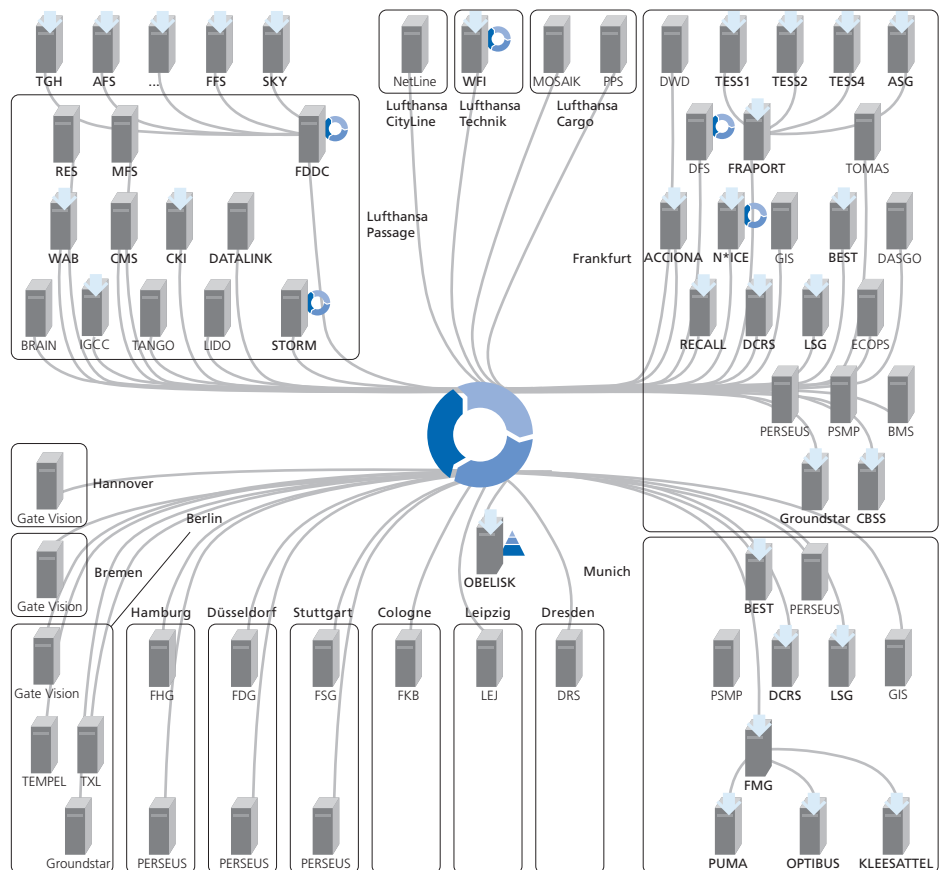


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Data Exchange Service for Deutsche Lufthansa

The Data Exchange Service (DES) is a mission critical Data Hub for Deutsche Lufthansa which connects central systems of the company with airports, local service providers and decentralized disposition systems. DES takes over the communication as well as the integration of different data (flight events, ground events, ..., call signs, ...) from several companies each with their own point of view.

Overview of the systems landscape:



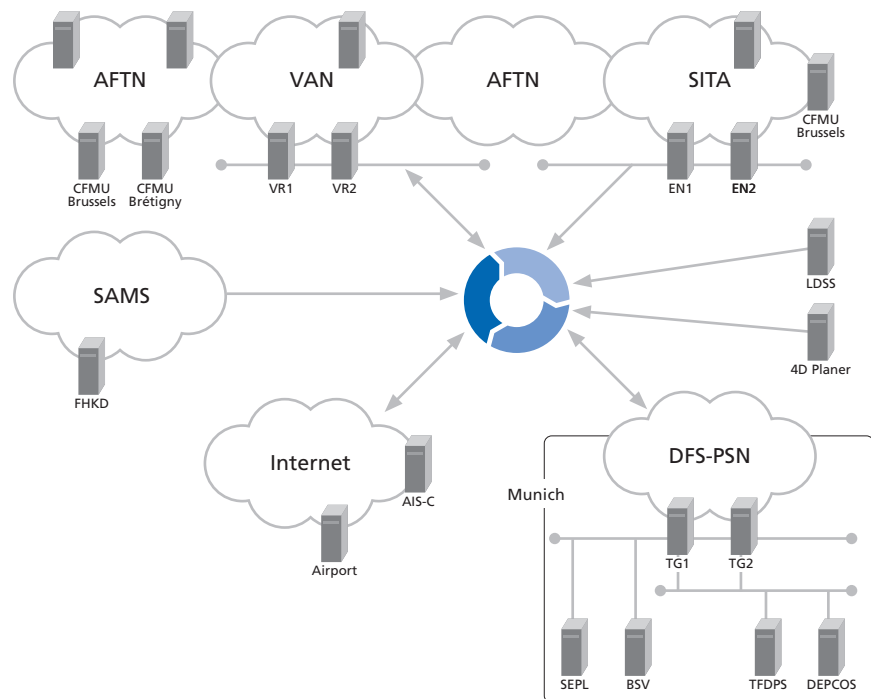
Challenge: Connection of more than 70 applications from more than 15 organizations (and indirectly to 25 other organizations) • More than 170 modules in a 7-day/24-hour operation with an availability > 99,995% (last measurement by customer: December 2006) • 500.000 transactions daily, 2.500.000 published telegrams • In line with standard protocols (COBRA, XML, ...) and standard formats (SSIM, SSM, ASM, ..., MVT, XML) – and a variety of proprietary interfaces

Technology: C++, J2EE • Oracle 9i • SunSoft Solaris, Veritas

STANLY_CDM for Deutsche Flugsicherung

The STANLY_CDM Data Hub is located at the Deutsche Flugsicherung (Air Navigation Service Provider, Germany) and connects Eurocontrol in Brussels with the major German airports using WANs (DFS-PSN, SITA, AFTN). It is the basis for CDM (Collaborative Decision Making). STANLY_CDM is not just relaying data. It links further systems with additional information for the benefit of delivering the "best from all worlds" combined in a standardized view.

Overview of the systems landscape:



Challenge: Composition of established interfaces (X25, DCE, RPC, ADEXP, ...) and modern technologies (Web Services, XML, ...) • Standardization of the XML data formats • Creation of a integration layer • Implementation of a data pool for analysis.

Technology: C++ • Oracle 9i • SunSoft Solaris, Sun Cluster



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Informationsdesign

Informationsdesign is a specialized systems house. We perform conception, development and operation of highly available data hubs (Enterprise Application Integration, EAI), client close data warehouses as well as modern data services for the intranet, internet and mobile internet. Our clients are airlines and airports primarily, but also computer retailers/ systems houses that we support in the design of solutions for the aviation market. Since more than ten years.

Selected clients

[Deutsche Lufthansa](#)

[Lufthansa CityLine](#)

[Lufthansa Cargo](#)

[Lufthansa Technik](#)

[Thomas Cook](#)

[Condor](#)

[Time Matters](#)

[DFS Deutsche Flugsicherung](#)

[Fraport](#)

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[Airport Leipzig-Halle](#)

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