Information and Communication Technologies in Tourism
Global Distribution Systems (GDS) and CRS

- Computer Reservation Systems (CRSs)
- Global Distribution Systems (GDSs)

- CRS/GDS are product of the 1960ies
- Main electronic interface in the travel and tourism market
  - "switch" between suppliers and intermediaries on one side and travel agents on the other side
- Shareholders have mainly been airlines, since management of airline seats and their distribution constitute their origin
  - Aimed at organising airlines internally and provided tools for improvement in productivity & efficiency
  - Acted as backbone of the digital airline
E-Intermediaries

(Fuchs/Höpken 2004; Fuchs et al. 2009)

Dis-Intermediation
TrC > PrC
but also...

Re-Intermediation
TrC = PrC and Value Added
Computer Reservation Systems (CRSs)

- **CRSs assist tourism enterprises**
  - Handle their inventories profitably
  - Facilitate the tourism product distribution
  - Normally operated by airlines, hotels & tour operators
  - Distribute products nationally or globally
  - Use mainframes & extensive networks to support remote terminals in travel agencies (nowadays also internet and web applications)

- **Advantages**
  - Support reservation/confirmation/purchase of a wide range of tourism products
  - Reduce transaction costs

- **Disadvantages**
  - High installation and usage costs
  - Lack of flexibility and user friendliness
  - Bias in favour of their suppliers
Global Distribution Systems (GDSs)

- **GDSs**
  - Horizontal and vertical integration of multiple CRSs
  - Emerged from CRSs as a one-stop customer service
  - Effectively became travel supermarkets, offering information & reservation capabilities for all products
  - Control and distribute most airline seats
  - Emerged as a main technology supplier
  - 4 major GDSs: Amadeus, Galileo, SABRE & Worldspan
    - Result of a permanent concentration process
GDS Architecture

(Werthner/Klein 1999)
Global Distribution Systems (GDSs)

- **GDS functions**
  - Reservation / booking – core-services
    - Flights
    - Accommodation
    - Car-rental
  - Reservation / booking – other services
    - Events
    - Package tours
    - Cruise
  - Complete handling of payment
  - Ticketing
  - Management functions
    - Reporting
    - Accounting
History of GDSs

(Kärcher 1997)
# Market penetration of GDSs

<table>
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<tr>
<th>Region</th>
<th>AMADEUS</th>
<th>GALILEO</th>
<th>SABRE</th>
<th>WORLDSPAN</th>
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</table>

(Werthner/Klein 1999)
GDSs – Global marketplaces

- **GDSs as global marketplaces**
  - Example of global electronic marketplaces
  - Represent very influential part of the market
    - Sabre Travel International employs 1,800 persons, covers 45 Mn of prices, contains 650 airline companies and performs **2,000 transactions per second**
  - In 1992 these systems had over **98%** of the entire market
  - Dominant position in specific markets
    - E.g. Amadeus/START in Germany
  - Example that early adopters of information technology can occupy a strategically dominant position
### History of Amadeus & Start

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<td>1971</td>
<td>Deutsche Lufthansa, Deutsche Bahn, TUI, abr, DER and Hapag-Lloyd establish <em>Studiengesellschaft zur Automatisierung für Reise und Touristik</em> (Society for the Automation of Travel and Tourism) – called <em>Start</em> for short</td>
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<td>1980</td>
<td><em>Start</em> is ready for operation</td>
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<tr>
<td>1987</td>
<td>Foundation of Amadeus by Air France, Iberia, Lufthansa and Scandinavian Airlines (SAS)</td>
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<td>1992</td>
<td>Integration of Amadeus into the <em>Start</em> system</td>
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<td>1994</td>
<td>Implementation of the e-commerce sector</td>
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<td>1995</td>
<td>Take over of System One (USA)</td>
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<td>2002</td>
<td>Worldwide no. 1 GDS in travel agency bookings</td>
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<td>2003</td>
<td><em>Start</em> becomes Amadeus Germany</td>
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<tr>
<td>2004</td>
<td>Acquisition of OPODO online travel portal</td>
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<tr>
<td>2005</td>
<td>Amadeus goes private: Leveraged Buy Out (€ 4.37 billion market valuation)</td>
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</table>
Amadeus Germany business fields

- **Services for travel agencies**
  - Conventional travel distribution system
  - Integrated software solutions to support front, mid and back office workflow processes
  - Booking engines for web-based travel distribution
  - [www.de.amadeus.com](http://www.de.amadeus.com) - the B2B portal as an Internet platform for products and services
  - Employee qualification using various training methods
    - e.g. Travel Expert Certificates - Amadeus Germany in co-operation with IHK (Chamber of Commerce) Frankfurt am Main
  - Wide array of services e.g. help desk, on-site system consulting and customer support
Amadeus Germany business fields

- **Services for tour operators and service providers**
  - Comprehensive and neutral booking platforms
  - Booking engines for sale via Internet; customised Internet presence
  - Individualised training media and on-line help

- **Services for corporate accounts**
  - Products and consulting for online business travel management
  - Development of global solutions for companies operating internationally
Amadeus booking process support

- Consulting
  - Information search
  - Vacancy inquiry

- Sales
  - Option
  - Booking
  - Booking confirmation online

- Payment process
  - Online direct debit collection by the tour operator
  - Printing of remittance slips

- Documents
  - Travel confirmation also via email, fax
  - Travel documents

Additional services
Application transfers
VERS/VERJ
TV
CC
INFX
Amadeus system as an integrator

Amadeus Germany

Front/mid office products
Amadeus Vista
Internet products

Suppliers

- Rail 39
- Airlines 488
- Public Transport 68
- Hotels 239 chains 59,000 hotels
- Cars 42 providers in 31,000 locations
- Rail 2 providers Cruise 7 providers
- Insurances/Credit cards 5 / 5 providers
- Tour operators 190
- Deutsche Bahn
- Amadeus
- Hotel
- Event providers 180
- Ferries 33
- Rail + bus providers 4

Customers

- Business Travel
- Travel Agencies
- Travel Agents
- Company Travel Units
- Advance Ticket Sales
- Consumers
- Computer centers
- Private customers
- Corporates

Rail 39
Airlines 488
Public Transport 68
Hôtels 239 chaînes 59.000 hôtels
Cars 42 fournisseurs dans 31.000 localités
Rail 2 fournisseurs Cruise 7 fournisseurs
Insurances/Credit cards 5 / 5 fournisseurs
Tour operators 190
Deutsche Bahn
Amadeus
Hotel
Event providers 180
Ferries 33
Rail + bus providers 4
Front/mid office products
Amadeus Vista
Internet products

Business Travel
Travel Agencies
Travel Agents
Company Travel Units
Advance Ticket Sales
Consumers
Computer centers
Private customers
Corporates
Amadeus technology

[Diagram showing Amadeus technology infrastructure with various connections and nodes such as Data centre, Firewalls, and Service providers.]
Travel agency hardware

- **Hardware components in travel agency**
  - Amadeus PCs
  - Multi card board distributed by Amadeus
  - Document printer
  - System printer
  - Hardware extension/add-on products
    - POS terminal
  - Standard PC
  - Optional full service
  - Automatic software update
Facts & figures

- 45.131 PCs - in Germany: 40.137
- 3.3 million transactions/year
- 627 transactions/second (maximum value 2005)
- 106 million bookings
- 116 million tickets
Market trends

Tourism: concentration and internationalisation of key accounts

Direct booking/fulfillment

Service provider
Tour operator

Amadeus Germany
Travel agency
Fulfillment

Corporate customers
Private customers

Direct sales
Tight competition

Traditional sales channel
New sales channel
Leisure travel distribution in travel agencies

- Only 2-4% of overall sales process spent on determination of customer demand
- Current USP of travel agent: knowledge of booking process
- No process integration of determination of customer demand, search for offers and booking
- No simultaneous access to systems of different suppliers
- No support of yield management
- Insufficient management information about overall sales process
LTS objective

- Optimising the leisure travel sales process in travel agencies
  - Better support of determination of customer demand
  - Integration of determination of customer demand, search for offers and booking into one system
  - Support of travel agency in optimising sales process and maximising revenue

- Support of complete sales process in an integrated environment
LTS objective

Sales Process

Front-Office-Workflow

Sales Control

Yield-Management

Mid-Office

Management Information
Leisure Travel Database

- Comprehensive database for all Amadeus leisure travel applications
- Definition of a standard DB schema for tourism services
  - Abstraction of catalogue views to a pure tourism services oriented view
  - Mapping of proprietary attributes to the Amadeus standard
- Flexible import process
  - Import catalogue data (offline data)
  - Online data delivery from suppliers
- Content
  - Tourism services: hotel, accommodation, flight, ...
  - Additional information: region, climate, immigration instructions, health rules, ...
Leisure Travel Engine

- Business logic for automating availability check and booking process
- Encapsulation of supplier-specific processes and details of supplier systems
  - No need for suppliers to adhere to a standard
- Value-added services by aggregating basic services
- Externalisation of business rules
  - Business logic defined as business rules (and not as part of the software)
  - Maintenance of rules by domain experts
Leisure Travel Workflow

- Coverage of tourism services of all types
  - Single services, fix packages, dynamic packages
- Flexible determination of customer demand
- Multi-supplier search, availability check and booking
- Illustration of offers
  - Display of offers depending on customisable parameters
  - Detailed offer and travel information e.g. hotel pictures
- Integration of all phases of sales process
Leisure Travel Control

- Administration of steering criteria to control sales process
- Hierarchical authorisation concept
- Online update (within whole organisation)
- Basic steering criteria
  - Assortment (supplier priority and filter)
- Supplemental criteria
  - Departure/destination airport, destination, ...
  - Quality e.g. price, category, carrier, hotel-chain
  - Time e.g. travel date, query date
Terminal-oriented User Interface
LTS User Interface
## LTS User Interface

![Amadeus Vista - Microsoft Internet Explorer bereitgestellt von Start Amadeus](image)

### LEISURE TRAVEL SOLUTION

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Traditional Sales Process

Precise offer of **one Service Provider**

Customer → Travel Agency → 1A → SP₁ → SP₂ → SP₃ → SP₄

**Request in TOMA**

2 weeks package tour to Majorca in August for max. € 1000,-

Input of SP, travel type, date, service code
LTS Sales Process

Offers that meet customer demands from defined Service Providers

1. Hotel X, Tour Operator A, 01. - 15.08., 945,- €
2. Hotel Y, Tour Operator B, 02. - 16.08., 975,- €
3. ...

Request

2 weeks package tour to Majorca in August for max. € 1000,-

Demand

- Majorca, tour package
- 2 weeks, August
- € 1000,-
LTS Architecture

- **Design goals**
  - Define an architecture that is **robust, flexible and extensible**
  - Develop a **modular, layered** architecture that allows for **separation of concerns**
  - Adhere to **open standards** (J2EE, XML, ...)
  - Minimise the development effort by **delegating as much work as possible to the infrastructure** (web and application server)
LTS Architecture: Logical View

Frontend

Middle-Tier

Backend

Service Provider Systems

LTW - Client

LTC - Client

LTS

C

D

E

W

TOMA

Catalogues (DB)

SPS

SPS

SPS

International Federation
for IT and Travel & Tourism

ICT in Tourism © copyright IFITT
LTS Server Components

**LTW (Workflow)**
- Demand analysis
- Processing of dynamic offer queries
- Priority control
- Availability check via LTE

**LTC (Control)**
- Hierarchical management of control information for control units
- Creation of control related client information

**LTE (Engine)**
- Availability check and booking
- Encapsulation of SPS specific knowledge (complexity hiding)
- Rules engine maintainable by a domain admin

**LTD (Database)**
- Unified view of SPS specific data (import)
- Query execution
LTS Architecture: Technical View

LTS and involved systems

LTS Client

VISTA

LTW Applet

Web Server

LTS Services

LTS Applications

Web Server (Apache)

Portevo

LTC Applet

STADI

Login and User Management Service

Service „Verfahren“

RDBMS Oracle

SUN

X_LTD

System Integration Platform

ASW Link

WS Link

SIP

BS2000

ASW

SUN

PC

HTML HTTP

SOAP HTTPS

SOAP HTTP

RMI

HTTPS

HTTP

XML IIOP

LTS Link

SOAP

HTTPS
LTS layered Architecture

- System responsibilities are separated into functional layers
- Each layer has its own responsibilities and its own API
- Layered architecture leads to a more flexible and maintainable system
  - *Encapsulation* — Each layer can hide details about its operations from other layers. Thus the layer can evolve as needed behind a fixed API without affecting its clients.
  - *Separation of concerns* — Complexity in the system is easier to manage because each layer is focused on a cohesive set of responsibilities.
  - *Reuse* — Adding additional functionality is faster, because each layer can provide services to objects in the layer above. Furthermore, classes in a given layer can inherit reusable behaviour from a superclass, thus abstracting the responsibilities of classes of that layer.
LTS layered Architecture

- **Presentation Layer**: Manages user interaction, manages screen infrastructure, syntax validation.
- **Application Layer**: Manages C/S communication, invokes services, handles exceptions, maintains HTTP sessions, manages workflows.
- **Services Layer**: Domain specific services (use cases), general services, transaction control.
- **Domain Layer**: Domain model, business behaviour, semantic validation.
- **Persistence Layer**: O-R mapping, basic services (create, read, update, delete).
- **Integration Layer**: Access to the back end systems (ASW).
LTS Component Model
The layering model of LTS enables the creation of a service-oriented architecture

Advantages of a service-oriented architecture

- Many different applications can share a suite of services, while also using services that are unique to each application.
- Likewise, different kinds of clients (for example Web, Swing-based or .NET applications) can use the same services, providing a consistent application architecture.
Summarisation of Design Aspects

- **Service-oriented architecture**
  - Functionality provided as web services
  - Support of different client types (web/html, Java applets, .NET applications)
- **Rich client approach (Java applet)**
  - Sophisticated GUI with complex workflow
- **Layered architecture**
  - Separation of system responsibilities into functional layers
  - Leads to flexibility, extensibility, reusability
    - E.g. reuse of database or booking engine
- **Built on open standards, tools and technologies (J2EE, XML, ...)**
- **Minimisation of development effort by delegation of tasks to infrastructure (web and application server)**
Performance and Scalability

Performance-related design issues
- LTS system partitions computational responsibilities between clients and servers to maximize CPU potential.
- LTS clients store static and session-based data locally in order to reduce both network traffic and the server-side memory consumption.
- LTS server-side processing is stateless.
- Thus LTS can make full use of the load balancing and scaling capacity provided by web and application servers.
- To speed data access LTS uses the database connection pooling and data caching provided by the EJB container.

Lessons learned
- Application server less performant than database.
- Scalability of BEA WLS problematic.
- Server farm appropriate for application server.
Case Study – CRS / GDS

GDS’s respond to IATAs planned new distribution capability


International Air Transport Association (IATA) will push for a revamp of digital operations by recommending a foundation standard for a new distribution capability (NDC)
Travelport shows off Facebook flight search and booking system prototype


Travelport developed the e-volve app, a platform where users can search and book flights for any airline via the Travelport GDS feed through the ePricing service coming into the Universal API.
Case Study – CRS / GDS

Amadeus secures two launch agencies for m-Power mobile travel app

http://www.tnooz.com/article/amadeus-secures-two-launch-agencies-for-m-power-mobile-travel-app/

m-Power is a white label travel application which can be re-skinned with the branding and functionality required by the OTA or travel management company.
Case Study – CRS / GDS

Amadeus finds disgruntled business travelers in state of the nation study


Amadeus tries to establish a more touchy-feely relationship between travelers and travel managers while still balancing the needs of the business and the traveler’s own priorities.