Intelligent Networks

T-110.300/301

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Intelligent Networks

- Based mainly on the lecture material from Pasi Kemppainen at Intellitel Communications Ltd. for this course on autumn 2001
- Also "Intelligent Networks" by Thomas Magedanz & Radu Popescu-Zeletin

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History

- The most intelligent switches (humans) were gradually replaced by electromechanical switches in the first half of the 20th century
- Analog transmission started to lose ground for digital in the backbone in the 1960's
- This lead to the idea of digital switches, then called "Stored Program Control" switches
- Management databases emerged at the 1970's
- Freephone (800) services etc. at 1980's (by proprietary technology)
- Intelligent Networks
  - The idea of supplementary services (calling cards and 800-numbers) launched the "Intelligent Networks" concept, first as a marketing hype
  - Objective; to separate services and switching, and vendor independence

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IN Motivation

- Revenues
  - Revenue for carrying data (€/bits) is low
  - For voice, it is better, but it would not hurt to earn more
  - It is possible to charge for supplementary services;
  - Supplementary services also create additional traffic, and new customers
- Cost reduction

IN Development

- IN/1 was developed by Bellcore (the research and development institution of the "Baby Bells" generated by the separation of AT&T. 1986
  - SCP (Service Control Point), SSP (Service Switching Point) introduced as concepts
  - used SS#7 signaling
  - for creating new services both SSP and SCP needed to be updated
  - three services; freephone, credit card billing and private numbering plan
- Further development after this at Bellcore and ITU

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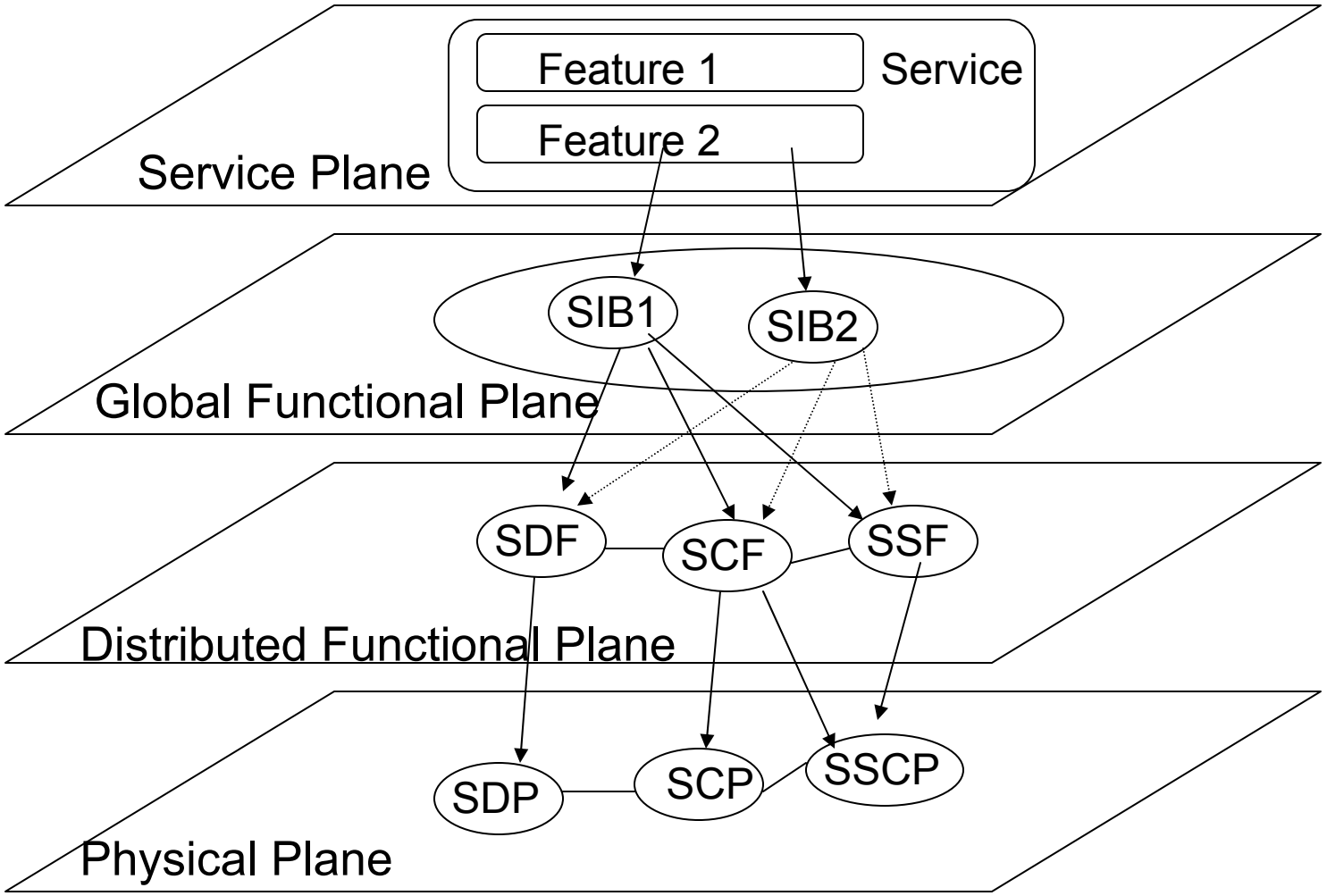
IN Objectives

- Open standards, vendor independence
- Rapid service creation and deployment
- Centralized subscriber and service data management
- Differentiated services to customers
- Rapid adaptation to market needs and competition
- Competitive advantage
  - Proprietary systems are expensive to maintain
  - Standards for reducing service introduction costs
  - To enable multivendor networks
  - To centralize service management for a specific customer

IN Conceptual Model (INCM)

- INCM defines a top-down approach to service creation
  - Service requirements are mapped to SIBs and further to the physical plane
- Four level model
  - Service Plane (Services, Service Features)
  - Global Functional Plane
    - SIBs (Service Independent Building Blocks) for service creation
  - Distributed Functional Plane (Functional Entities)
  - Physical Plane (Physical Entities, protocols)
- INCM does not describe the IN system, it is a tool for designing services

INCM



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Some IN Services

- Freephone, 800 numbers
- Premium charging (600, 700, 900 numbers)
- Call forwarding
- Follow-me diversion
- Call limiter
- Automatic call back

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Freephone Implementation

- The switching system recognizes the 800 prefix
  - At the SSP, Service Switching Point
  - The SSP is usually a digital exchange with IN capabilities
  - The 800 prefix is one of the *triggers* the SSP recognizes
- The SSP queries the SCP, Service Control Point for instructions on handling this call
- The SCP has the functionality to connect the call
  - Can be a direct mapping of the number or a complex time and region dependent dynamic function

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Service Feature Interactions

- The "unsolved" problem of IN
- How to combine different services without unforeseen consequences
- E.g. Freephone and call-forwarding used together, should
  - Freephone calls not be forwarded
  - Freephone calls be forwarded and the first called party pays
  - Freephone calls be forwarded and the forwarded-to party pays
- Only solution is to define allowed interactions of all the services when new services are introduced
  - The whole network can be seen as a single machine
    - Additional data may be requested from a database in SDP, Service Data Point

Service Independent Building Blocks

- A SIB has the following functionality
  - It is a reusable building block, describing a single complete activity
  - It has a unified and stable interface
  - It is completely independent of any physical architectural considerations
- The SIBs are a powerful concept in the IN service creation
  - SIBs are descriptions, not physical components
- SIBs are located in the global functional plane

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Some SIBs

- Basic call process
- User interaction
- Queue
- Charge
- Screen: compares identifier against a list
- Status notification: provides status of network resources
- Translate: translates input information (e.g. telephone number) and parameters (e.g. time) to output information

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Functional Entities

- In the distributed functional plane
- These are functions performed by the physical components
  - Client-server relationships
  - Information flows

CCAF	Call Control Agent Function, interface between subscriber terminal and switch
CCF	Call Control Function, means for controlling bearer services, call and connection handling in the traditional sense
SSF	Service Switching Function, recognize calls requiring IN service, interaction with call processing and service logic

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Functional Entities cont.

SCF	Service Control Function, the logical control for IN calls (service logic)
SCEF	Service Creation Environment Function, tools for creation, verification and testing of new IN services
SDF	Service Data Function, access for service related data and network data
SRF	Specialized Resource Function, end user interaction with the network using DTMF, voice recognition, announcements etc.
SMF	Service Management Function, service provisioning and management control, access to IN functional entities

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Physical Plane

- The actual components and products that implement the services
  - Related to Functional Entities
  - E.g. CCAF (Call Control Agent Function), CCF (Call Control Function) and SSF (Service Switching Function) are implemented by a Service Switching Point (SSP)
    - Note that SSP means Signal Switching Point in SS#7, in practice it is usually a local echange

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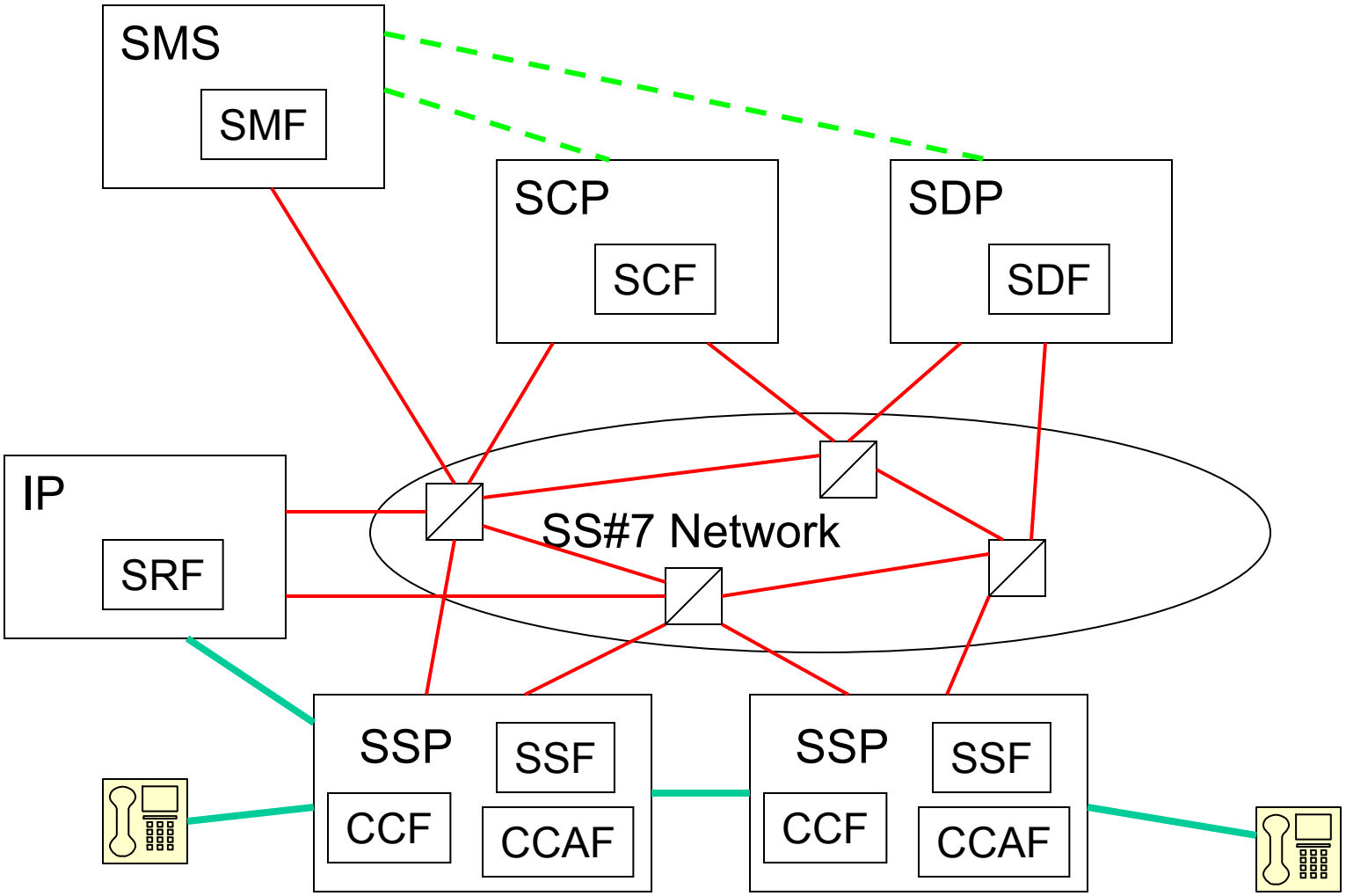
Simplified IN Architecture



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Service Switching Point, SSP

- A PSTN exchange modified to recognize and trigger IN services
- Can have dialogues with different Service Control Points (SCP)
  - Trigger points define the required IN services
  - Interconnections via Signaling Transfer Points (STPs)
  - SS#7 used for talking to SCPs

- SSP + Service Control Function + Service Data Function = SSCP, Service Switching and Control Point

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Service Control Point, SCP

- Service logic is implemented in Service Logic Program (SLP)
- Services (SLPs) are run in Service Logic Execution Environment (SLEE)
- Service Data can be located in Service Data Point i.e. (relational) database
- Service interfaces (talks) to the SSP using TCAP or INAP protocols
- High availability (doubled)

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Service Management System, SMS

- Allows operator to load new services to SCPs
- Supports centralized subscriber and service data management
- Gathers billing data and statistics
- Ensures data consistency in SDPs
- Often proprietary interfaces and protocols
  - TMN (Telecommunications Management Network) specified in ITU CS2 standards for IN

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Intelligent Peripheral, IP

- Manages specific resources, such as
  - Announcements
  - Speech recognition
  - Protocol conversions
- Can be an interface to services outside the IN
- Often integrated with SSP
  - Interface includes both signaling and data

IN summary

- Intelligent Networks consider the whole telephone network to be one giant machine consisting of smaller parts
- Services can be created of building blocks
- The functionalities are standardized and vendor independent
- IN has been important for the creation of mobile telephone networks

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