Session IV_b: **Work-in-Progress 1**

Chair: Hendrik Berndt, *TINA Consortium*

Characterisation of TINA kernel transport network load using models of the service components, DPE implementation and network topology

R.A. Achterberg, H.E. Hanrahan and F.J. Scholtz
University of the Witwatersrand, Johannesburg.

Overview

- Objective of modelling and simulation
- Modelling TINA services
- Modelling the distributed service components
- Model and simulator implementation
- Types of results available
- Conclusions and future work

Problem Statement

- TINA offers separation between services and underlying network
- Services programmer is freed from concerns of object location and of underlying network
- The traffic on the underlying network must be understood if network is to be dimensioned and managed to perform well
- Experience in Intelligent Networks confirms need to understand signalling traffic

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Traffic aspects of TINA-based services

- This work is restricted to message traffic on the kTN
- Effect of object allocation policies
- Network dimensioning
- Resulting latencies for service actions
- Load control and overload protection (future)

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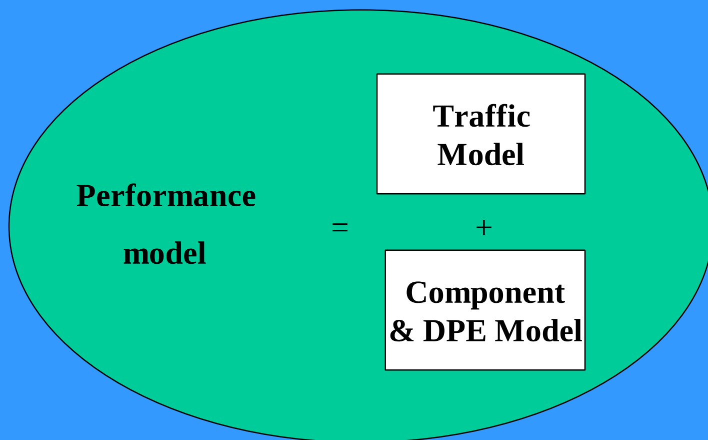
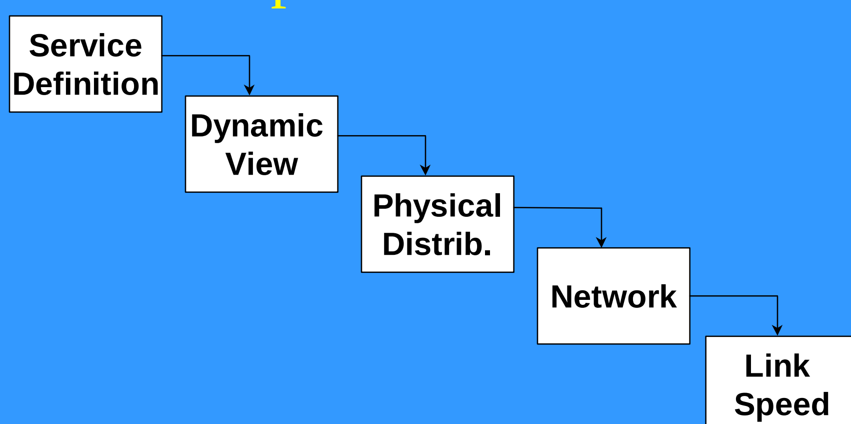
Performance Model



5-step Traffic Model



Service Definition & Dynamic View

- What are the actual or hypothetical services to be simulated?
- What components are involved in the service?
- What is the sequence of operations? MSCs are available for sample services to give dynamic view

How are objects distributed across DPE platforms?

- What processors do we have to host computational objects?
- What is the processing rate of each processor?
- How many messages can be queued in each processor?
- How are eCOs deployed at capsule level?

Network and Links

- What is the kTN topology?
- How many bytes need to be transferred for each message?
- What overhead must be added for stubs, skeletons etc
- What are the maximum data rates on each link in the kTN?

kTN Link representation

- DPE nodes may not be fully interconnected and traffic concentration may occur
- Each link is represented by FIFO queue of specified length
- Data is extracted from FIFO at maximum link rate

Model 1: Traffic

Each service is represented by:

- Objects allocated to processors
- Sequence of object interaction messages
- Messages have defined length: content is not modelled
- Messages pass over kTN links with defined queue length and transfer rate

Model 2: Service Components

A capsule is represented by

- A FIFO queue of selectable length
- An execution time, giving the extraction rate from the queue, also influenced by processor power

Other queue models can be added if required

Simulator

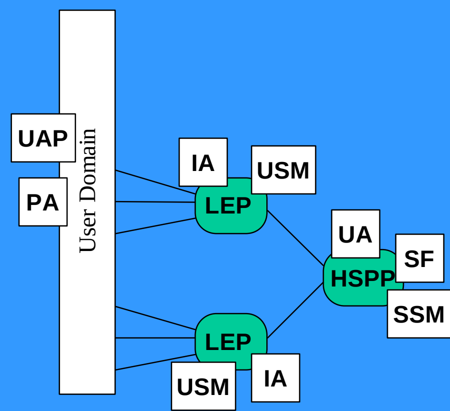
The simulator implements:

- The traffic model, giving the sequences and amounts of data
- The DPE component model reflecting the processing power
- A User Domain
- Time base, logging, ...

User domain

- User domain components are initiators of traffic
- Time-varying Poisson arrivals of user events
- Distribution of service logons events to pools of users at ingress points

Putting it together



Sample Networks

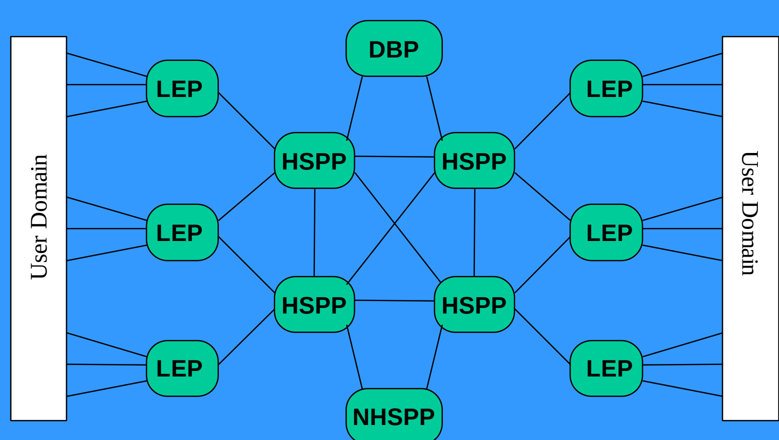
Networks studied to date are hypothetical network but topology is based on:

- Processing near point of service
- Core processors, fully interconnected
- Database processors
- Network function processors

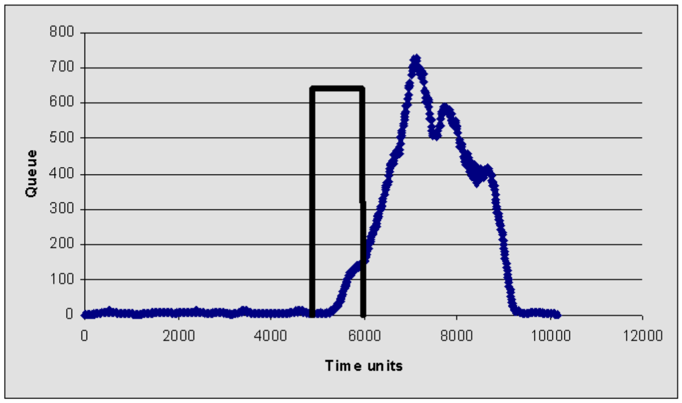
Library of processors

Processing Capability	**Supporting the Service Architecture**	**Supporting the Network Resource Architecture**
Specialized	DBP - Data Base Processor	-
Central - High connectivity	HSPP - High Speed Powerful Processor	NWHSPP - Network Control HSPP
Local	LEP - Local Exchange Processor	Network Control Processor
External	User Domain	Telecom Connectivity Provision

Hypothetical DPE Structure



Sample Result



Conclusions

- The simulator models kTN traffic in TINA, TINA-like or IN Systems
- Results available from Simulator:
  - kTN link loading
  - Latencies of operation such as logon, invite,...
- Has been used with estimated data
- Intend applying it to problems such as TINA-IN Adaptation Unit proposals

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The Layer Network Federation Reference Point

Frans Panken
John-Luc Bakker & Frans Pattenier
SAS-TAP / Forward Looking Work
Lucent Technologies

Overview

- Background
- Rationale
- LNFed
  - enterprise model
  - information model
  - computational model

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Background

- MESH R1 project
  Multimedia server, pre-product
- MESH R2 prototype project (nov. 1997 - nov. 1998)
  Implementation of TINA specifications
- FRIENDS prototype project (jan. 1999 - dec 2000)
  MESH R2 follow-up

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Rationale

- Based on Network Resource Architecture
- Retain connection-less features:
  - flexibility, adaptability
  - high resource usage at low costs
- Binding service differentiation
  - different binding services for different customers per connectivity provider

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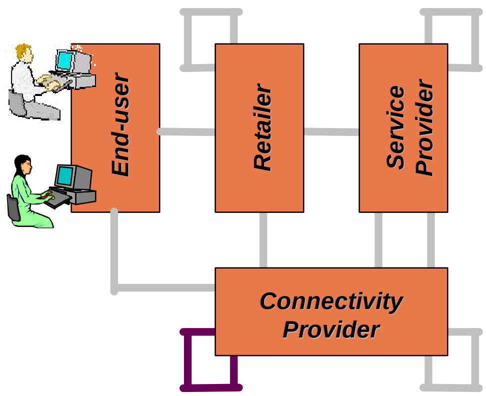
LNFed business model



- Access segment
  - authentication
  - authorization
- Usage segment
  - federated connectivity control
  - fault management
  - contract profile management

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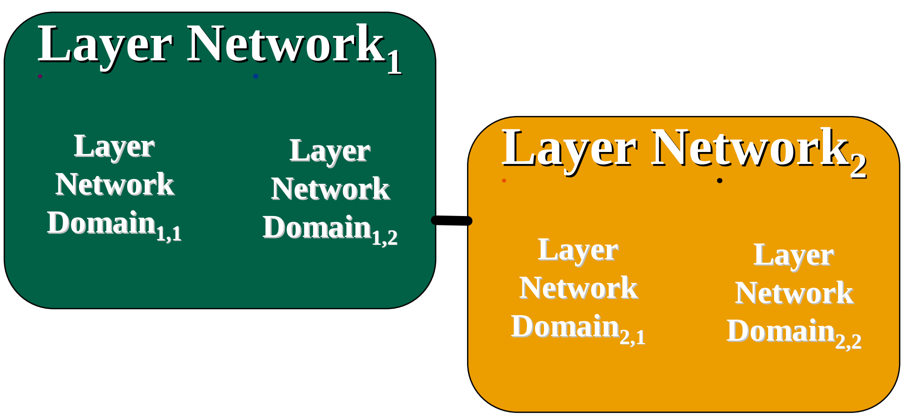
NRA concepts



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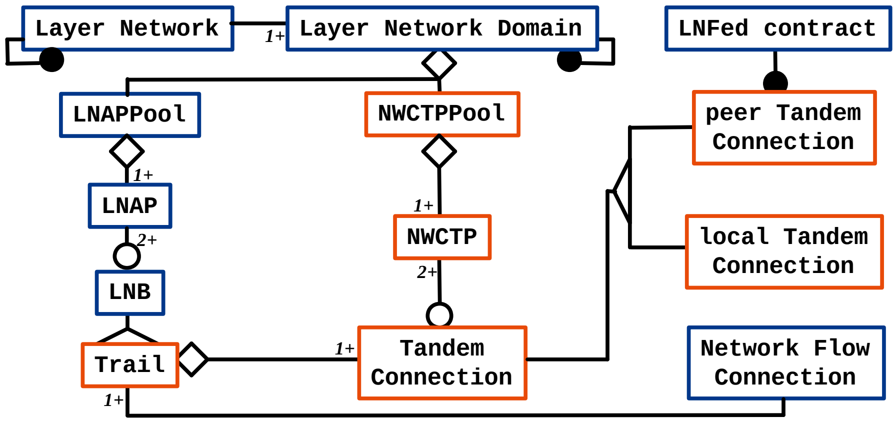
LNFed information model



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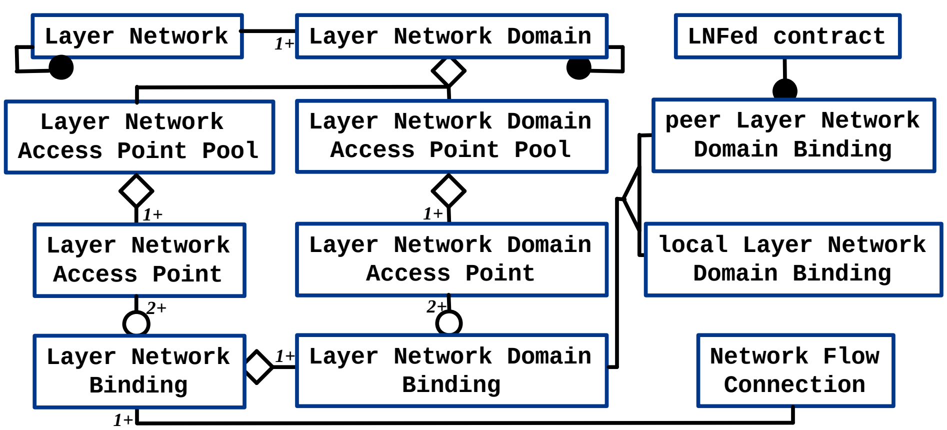
LNFed information model



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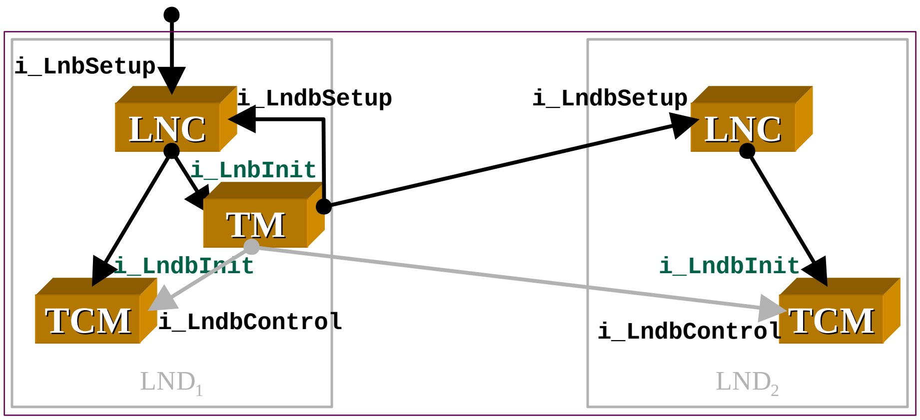
LNFed computational model (1)



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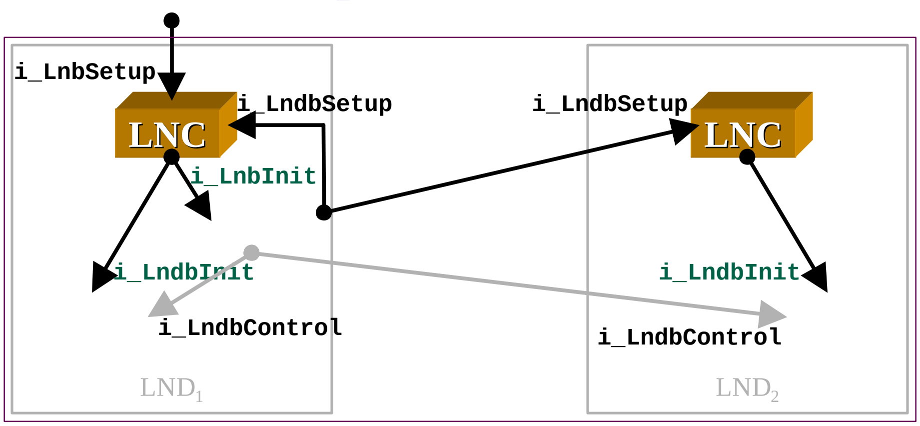
LNFed computational model (1)



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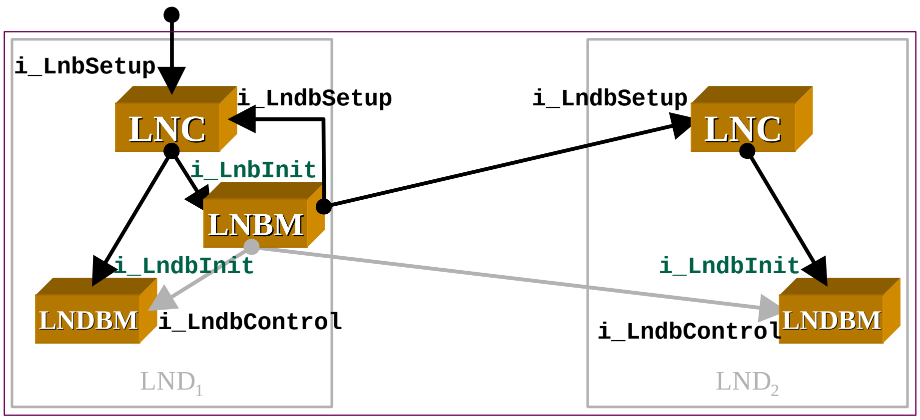
LNFed computational model (2)



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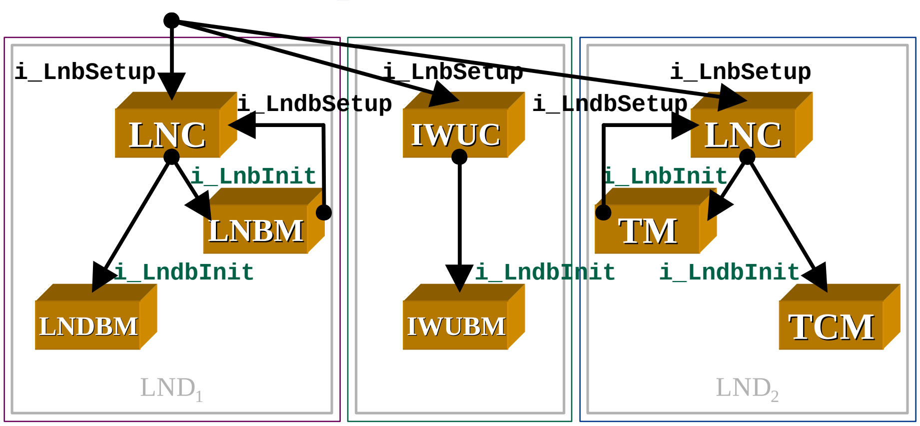
LNFed computational model (3)



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Realization of Personal Mobility Services in Various Situations

Faculty of Science & Technology,
Keio University

Outlines

- Background and Issues for realizing personal mobility service on the actual telecom. environment in the future
- Explanation of our proposed model
- Conclusions and Further works

Background

- TINA as a next-generation networking architecture based on the DPE:
  - for constructing open and global environment
    - cooperation between providers
    - universal access to telecommunication services
  - for coping with various users' requirements
  - **for realizing personal mobility service**
    - it enables users to use services that are personalized with their preferences and identities ubiquitously, independently of both physical location and specific equipment

Issues (1)

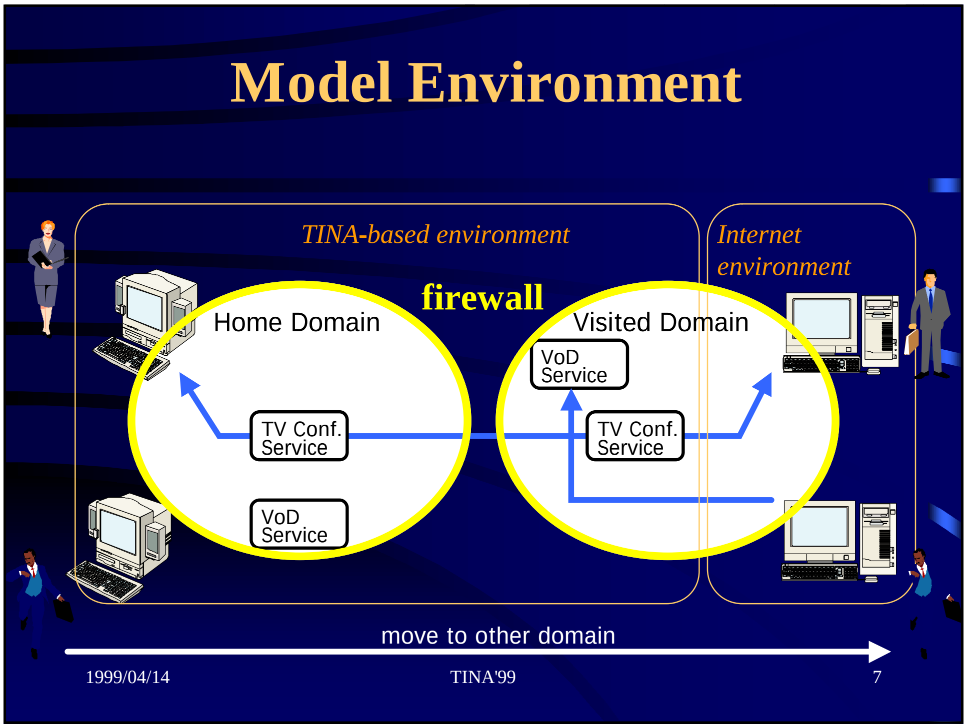
- Personal mobility for an end user who is on the non-DPE terminal.
  - Interoperability with non-DPE terminal is essential for the development and diffusion of next-generation network systems.
  - It allows:
    - providers to include legacy systems for a potential market.
    - end users to utilize attractive telecommunication services from the legacy Internet systems.

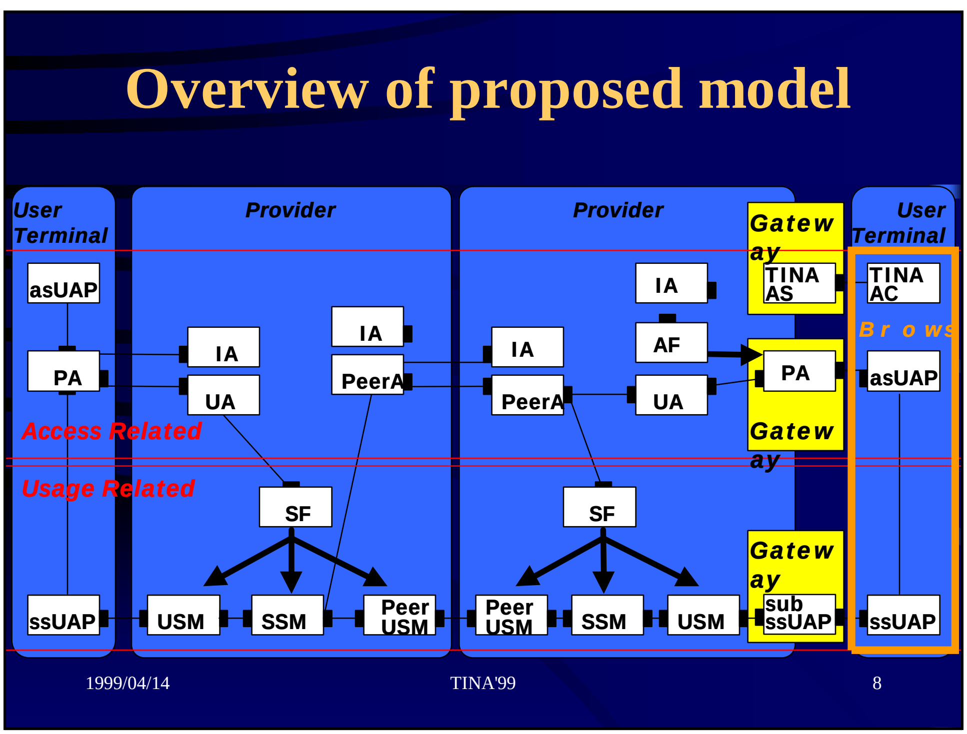
Issues (2)

- Personal mobility service for an end user who moves between domains.
  - Open- and closed-domain will exist on the actual telecommunication environment in the future.
  - It is needed to share a user profile between domains, for realizing personal mobility service.
  - However, all of the information in the user profile cannot be shared.

Proposal

- TINA-based practical model for realizing personal mobility service
  - Access to TINA services from the non-DPE terminal, with new approaches:
    - Adopting TINA as a promising networking architecture
    - Adopting the Internet as a network environment.
  - Procedure to exchange a user profile between domains.
    - Assuming that a domain is operated by one provider
    - Assuming that a domain is protected by a firewall, which is constructed corresponding to each domain.


Model Environment
TINA-based environment
Internet environment
firewall
Home Domain
Visited Domain
VoD Service
TV Conf. Service
TV Conf. Service
VoD Service
move to other domain
1999/04/14
TINA'99
7


Overview of proposed model
User Terminal
Provider
Provider
Gateway
User Terminal
asUAP
PA
IA
UA
IA
PeerA
IA
PeerA
IA
AF
UA
TINA AS
PA
Gateway
TINA AC
Brows
asUAP
Access Related
Usage Related
SF
SF
Gateway
ssUAP
USM
SSM
Peer USM
Peer USM
SSM
USM
sub ssUAP
ssUAP
1999/04/14
TINA'99
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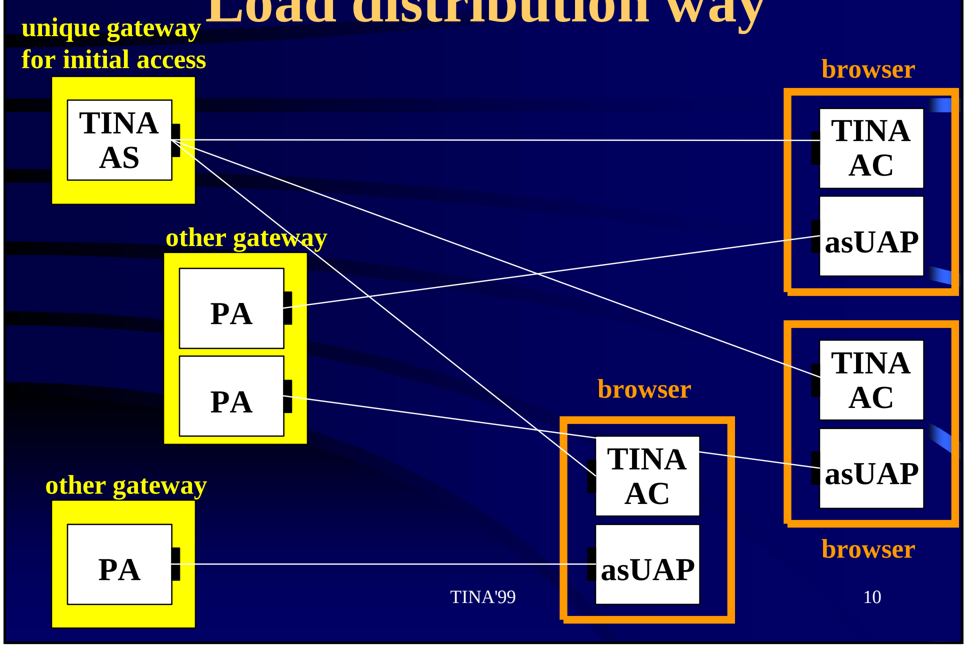
Advantages of our model

- To deploy the PA in the gateway allows:
  - system developer to fully utilize already-specified functions of it, as a server object.
  - users not to have to download it, that is, users can use relatively light-weight terminal.
- To separate the functions of legacy asUAP into two SCs allows:
  - end terminal to connect to different server, in the period of an initial access to a provider, and in the period of access session, respectively.

Load distribution way



Extension of user profile

- It should be divided into the generic part and domain-specific part:
  - to prevent confidential domain-specific information, from leaking out.
  - to reconstruct new user profile at the visited domain, using the generic part.
- The generic part should be pre-arranged in the contract between related domains.
  - The way to achieve this arrangement is further works.

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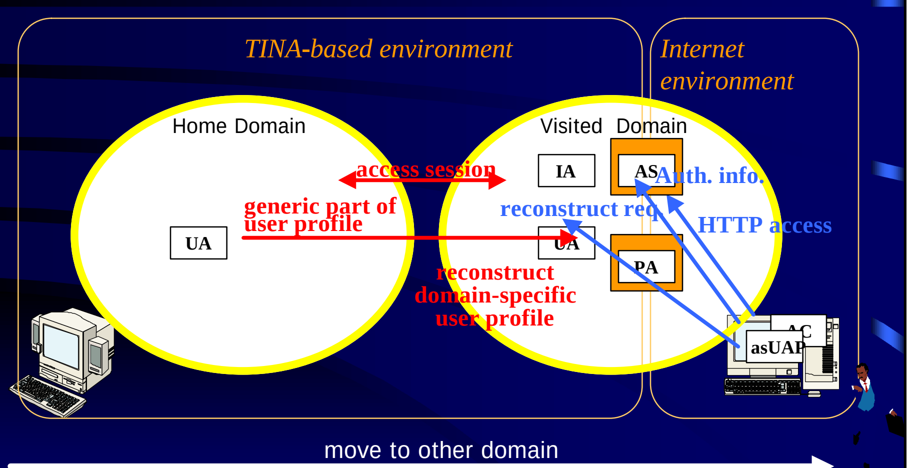
Procedure to realize personal mobility on the proposed model



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Conclusions

- Realization of personal mobility service on the TINA-based new network environment, in the following two situations:
  - Users utilize telecommunication services on the DPE, from the non-DPE terminal.
  - Users move between closed domains, that are protected by firewalls

We realized the practical model on the actual telecom. environment in the future

Further works

- Modeling the generic part of the user profile between domains
- Evaluation of load distribution way on our proposed model

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Mu3S

Multi-Service
Multi-Network
Multi-Terminal
Service Framework

A Middleware Platform for Telecommunications Information Networking

Frank Steegmans
Nicolas Mercouroff
Bruno Ceccaldi

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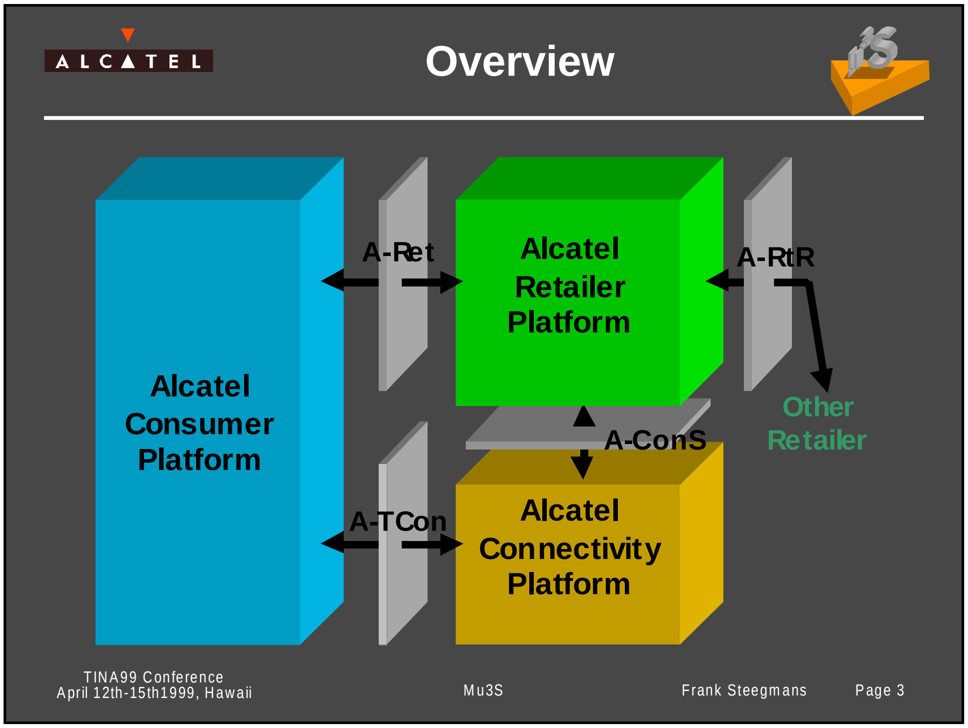
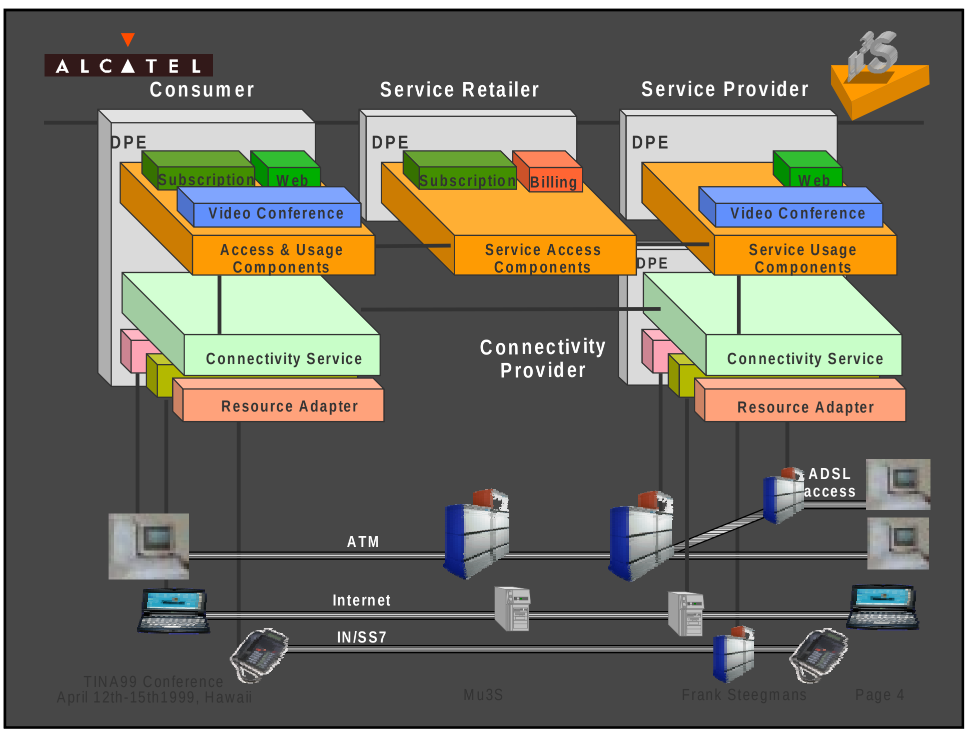
What is ‘Mu3S’?

- **Middleware Platform for integrating**
  - Heterogeneous Networks
  - Heterogeneous Services
- **Based on TINA specifications**
- **Component Ware**
  - Service Common Components
    - Service Access (authentication, announcements, invitations and more)
    - Feature Sets: basic, multi-party, stream-binding, voting, session control
    - Service Live Cycle Management
    - Service Federation
  - Network Components (supporting QoS propagation)
    - Communication (Codec & Session negotiation and selection)
    - Connectivity (Network and Network Provider Transparency)
    - Layer Network (ATM, IP, ADSL, ...)


ALCATEL
Overview
Alcatel Consumer Platform
A-Ret
Alcatel Retailer Platform
A-RtR
Other Retailer
A-ConS
A-TCon
Alcatel Connectivity Platform
TINA99 Conference
April 12th-15th1999, Hawaii
Mu3S
Frank Steegmans
Page 3


ALCATEL
Consumer
Service Retailer
Service Provider
DPE
Subscription
Web
Video Conference
Access & Usage Components
DPE
Subscription
Billing
Service Access Components
DPE
Web
Video Conference
Service Usage Components
DPE
Connectivity Service
Resource Adapter
Connectivity Provider
Connectivity Service
Resource Adapter
ADSL access
ATM
Internet
IN/SS7
TINA99 Conference
April 12th-15th1999, Hawaii
Mu3S
Frank Steegmans
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Objectives of Mu3S

- **Integrate advanced core functionality for:**
  - service control and management
  - network control and management
- **Offer**
  - Service Application Designers and Implementers
    - Extended set of (reusable) components
    - Abstraction of Network Levels
  - The infrastructure for
    - High-Level Service Creation
    - Automated Service Deployment
- **Live up to the demanding expectations of the modern telecom and information industry**
  - High performance, Scalable, Robust

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Visit Us @

- **Telecom 99, Geneva, October 10th until 17th at the KPN Research boot for the Enhanced Snelnet demo**

- **Alcatel's Corporate Research Center labs:**
  - Antwerp, Belgium
  - Marcoussis, France

Building a Fault Tolerant Distributed Processing Environment

Scott Stanley
Starvision Multimedia Corporation
sstanley@starvision.com

Starvision

- Located in Vancouver, BC, Canada
- A private company with 101 employees, founded in 1995
- Service Creation Management System (SCMS) offers a carrier class services platform for service providers
- TINA architecture was adopted in 1997 for the SCMS

Starvision's Products

- Starvision's SCMS platform offers multimedia services based on the TINA-C architecture
- A DPE was developed for this product, based on a commercial Object Request Broker
- Fault tolerance is the next major requirement for our TINA system
- Without standardized commercial implementations available, we had to design a customized fault tolerant strategy

Fault Tolerant DPE

- A critical requirement of a telecommunications system is fault tolerance
- Fault tolerance is the ability of a system to perform in a reasonable manner in the presence of faults
- DPE has an important role to play in making a TINA system fault tolerant

Basic Fault Types

- Logic fault in the application software
- Capsule failure resulting in a crashed or deadlocked capsule
- Hardware fault resulting in a DPE node failure

Fault Tolerant Strategies

- Warm standby model
- Checkpointing facilities
- Fault detection and recovery
- Fault recovery transparency

Commercial ORB Deficiencies

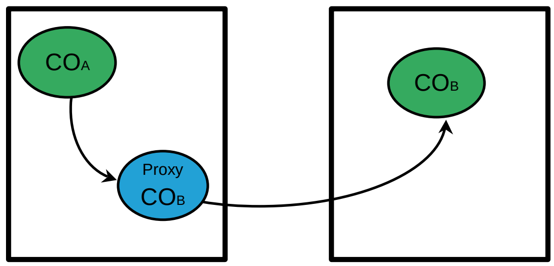
- Only stateless capsules can be restarted as checkpointing facilities are unavailable
- Capsule restarts and failover are not transparent to the client COs
- Deadlock detection is not available
- Warm or hot standby configurations are not supported

Fault Tolerant Design

- Smart proxies or stubs
- CO framework with checkpointing
- Capsule manager
- Node manager
- Non-TINA software

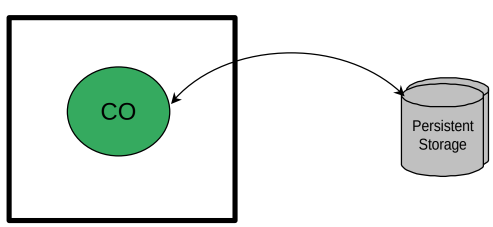
Smart Proxies/Stubs

- Smart proxies/stubs detect capsule failures and re-establish channels
- Smart proxy generator automates the creation of smart proxies



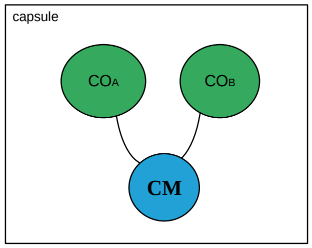
CO Checkpointing

- CO framework provides an incremental checkpointing facility
- allows CO state to be incrementally stored and restored to/from persistent storage



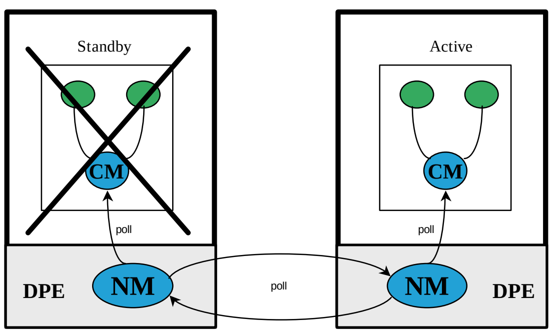
Capsule Manager

- Capsule manager is responsible for creating and managing COs within each capsule
- COs can report Fatal, Unrecoverable, and System Failure faults to their capsule manager



Node Manager

- Node Manager is responsible for managing and monitoring capsules
- Single Node Manager per DPE node



Non-TINA Software

- Node manager provides a mechanism for managing non-TINA software entities
- Cold standby model is deployed to guard against node failures
- Non-TINA software entities are restarted in the event of an entity failure

Current Status

- Starvision DPE is currently in the integration test phase
- Smart proxy generator, checkpointing, capsule manager, node manager components have all been developed
- SCMS application software development is underway using the DPE facilities and services

Current Status - cont

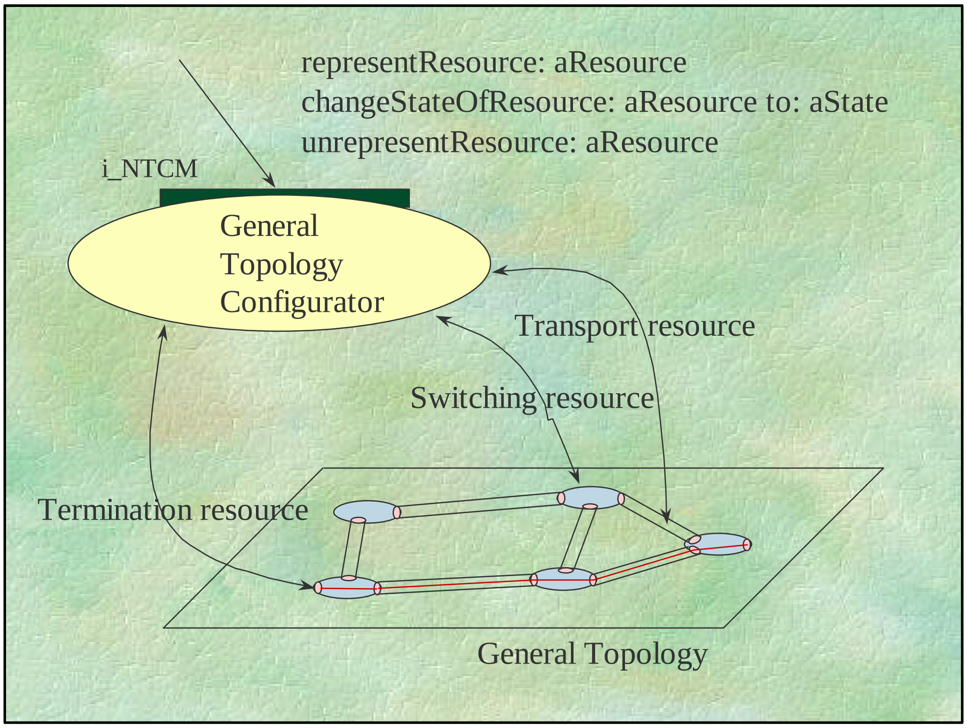
- We have successfully demonstrated capsule fault detection and recovery
- The CO checkpointing facility allows CO state to be stored and restored
- DPE smart proxies are providing seamless client reconnections
- When this work in progress is complete we will have a fault tolerant Distributed Processing Environment for our SCMS

Network Topology Configuration Management Extensions: An Experience Report

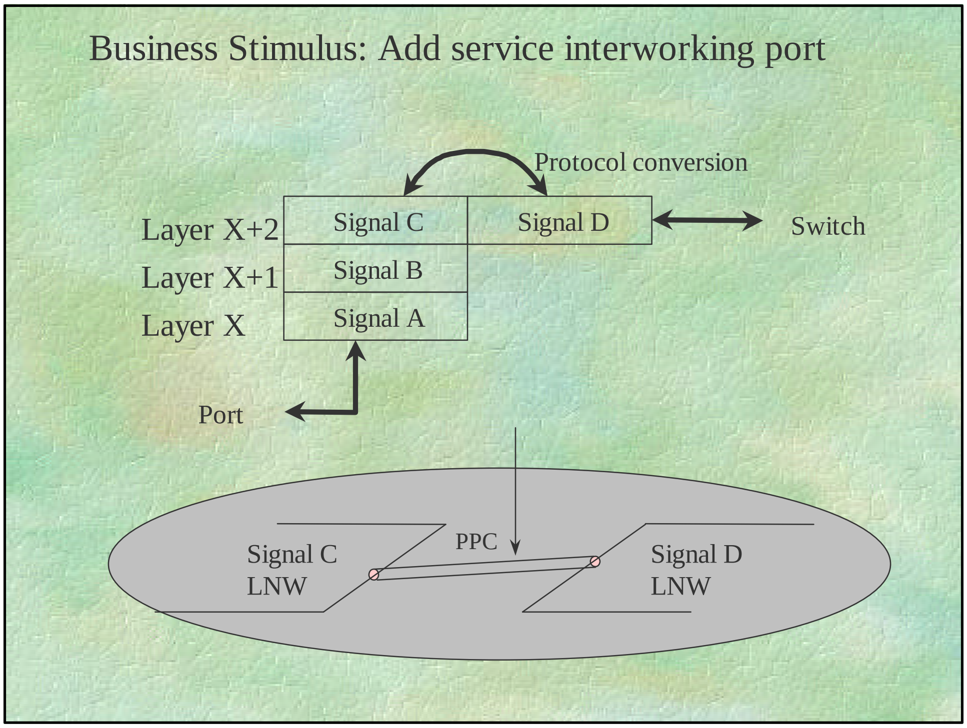
Sprint ION
Connection Manager Project

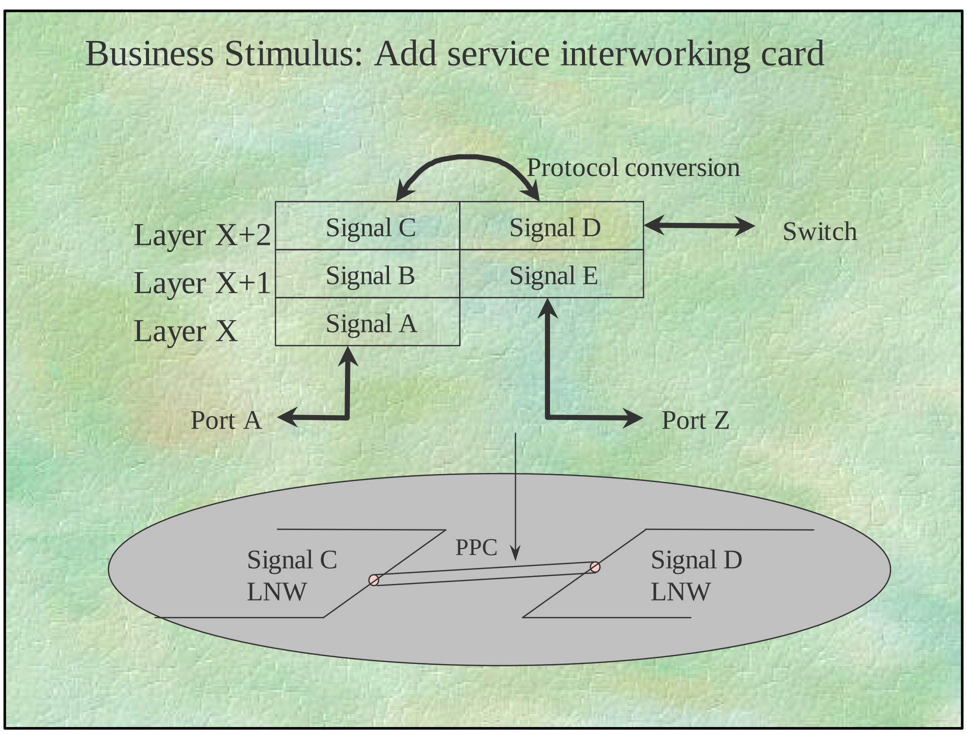
Steve Bannerman
Applied Reasoning
bannerman@AppliedReasoning.com

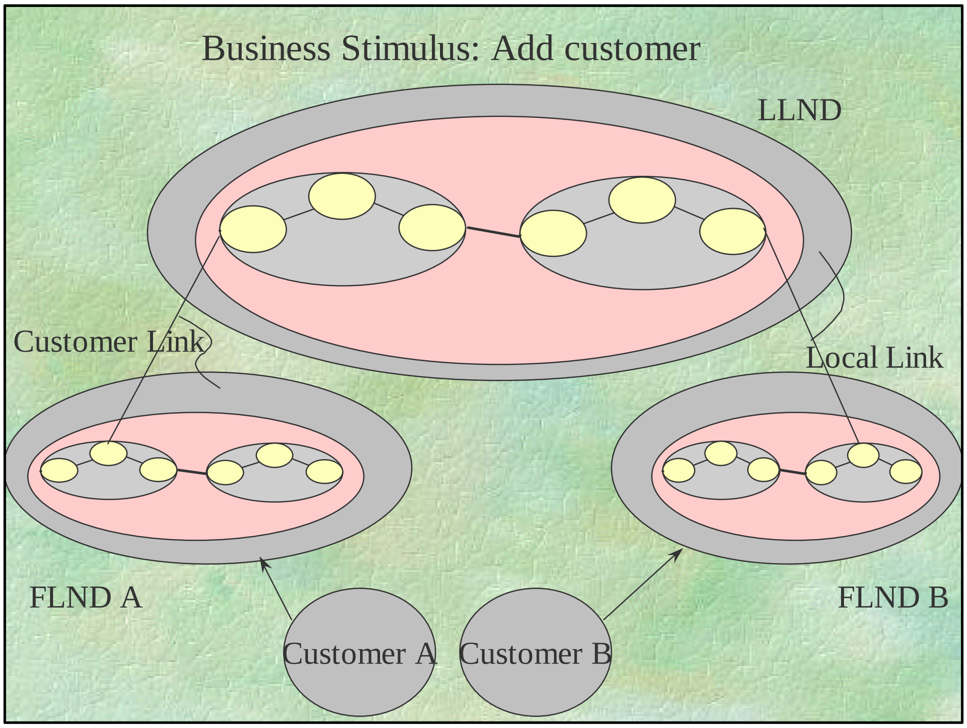
- **Background**
  - Sprint needed an integrated platform for provisioning connections across multiple technologies
  - TINA-C NRA recognized and accepted as a viable baseline
  - Advanced development effort executed to prove its concepts
  - Deployed Connection Manager in 1998 in support of Sprint ION
- **Current**
  - NRA based kernel being used to support production network
  - ATM, FR/ATM, IP over ATM, and Voice/Video over ATM
  - Release 1.5 in PRODUCTION, Release 2.5 finished development
- **Some Extensions (today's presentation)**
  - definition of mapping from business stimuli to resource lifecycles
  - extending generic network resources to accommodate business management rules (bandwidth, address, element management)

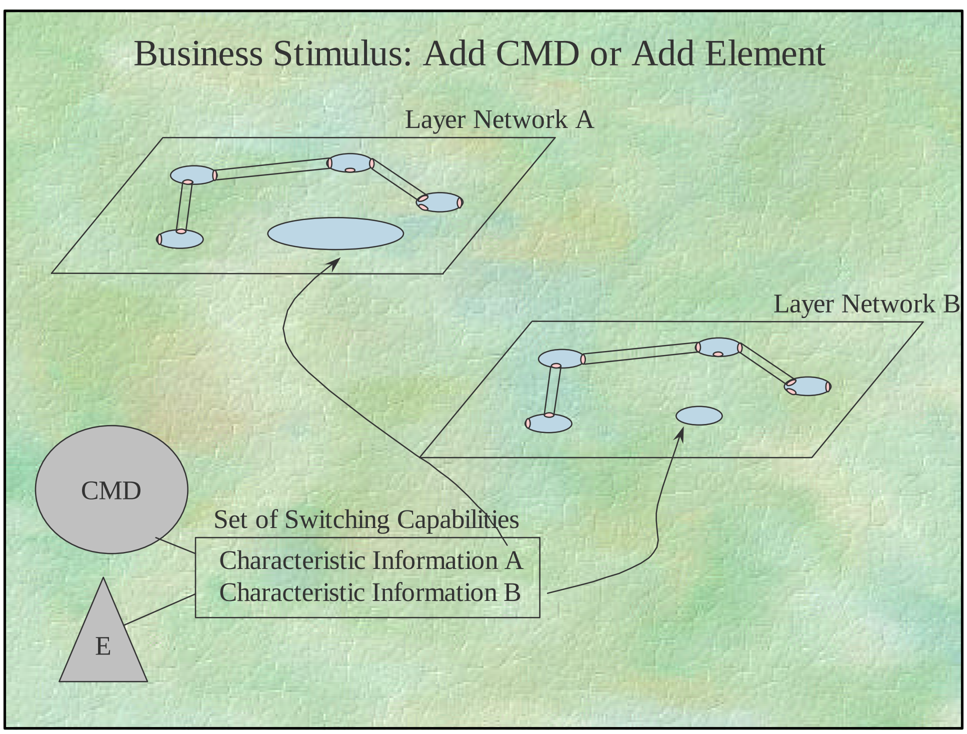


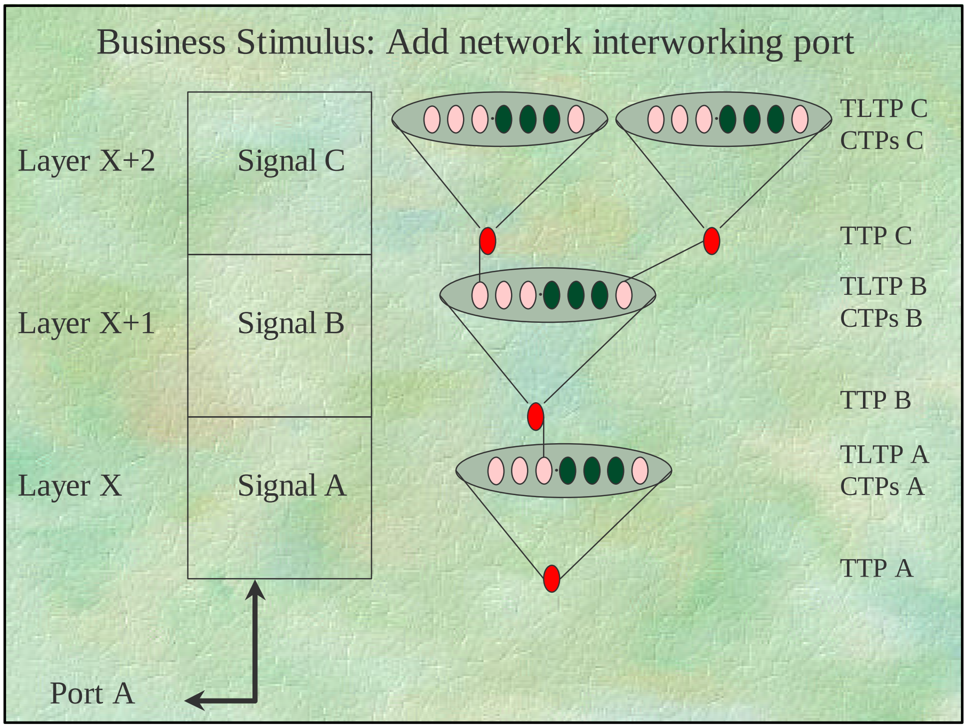
Mapping Business Stimuli to Network Resources

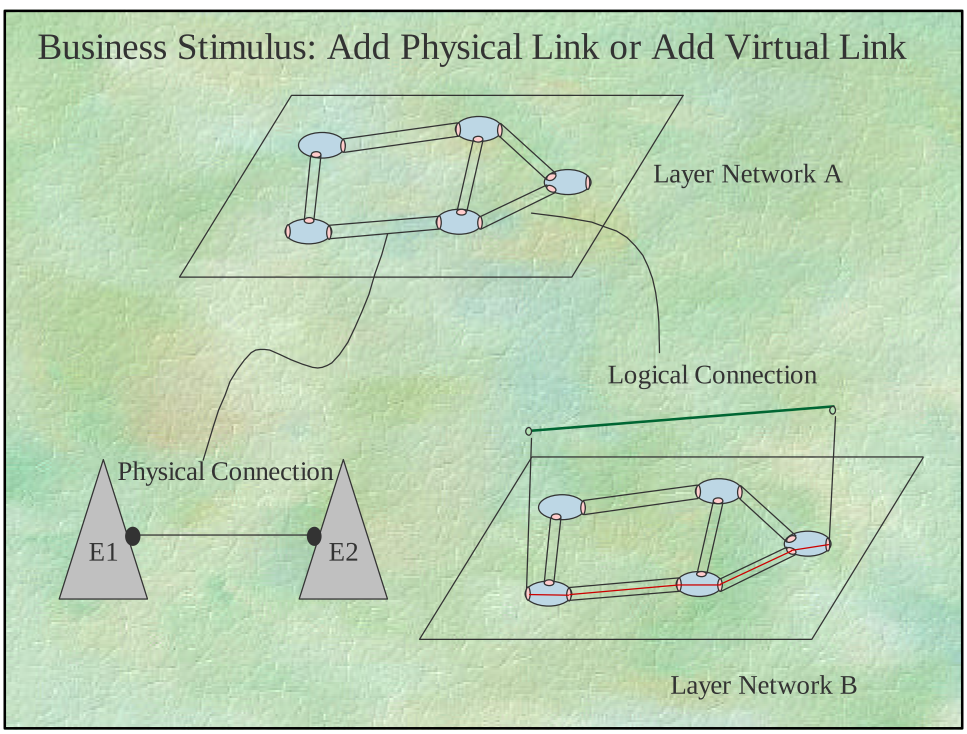

Business Stimulus: Add service interworking port
Protocol conversion
Layer X+2
Layer X+1
Layer X
Signal C
Signal D
Signal B
Signal A
Switch
Port
PPC
Signal C
LNW
Signal D
LNW


Business Stimulus: Add service interworking card
Protocol conversion
Layer X+2
Layer X+1
Layer X
Signal C
Signal D
Signal B
Signal E
Signal A
Switch
Port A
Port Z
PPC
Signal C
LNW
Signal D
LNW


Business Stimulus: Add customer
LLND
Customer Link
Local Link
FLND A
FLND B
Customer A
Customer B


Business Stimulus: Add CMD or Add Element
Layer Network A
Layer Network B
CMD
Set of Switching Capabilities
Characteristic Information A
Characteristic Information B
E

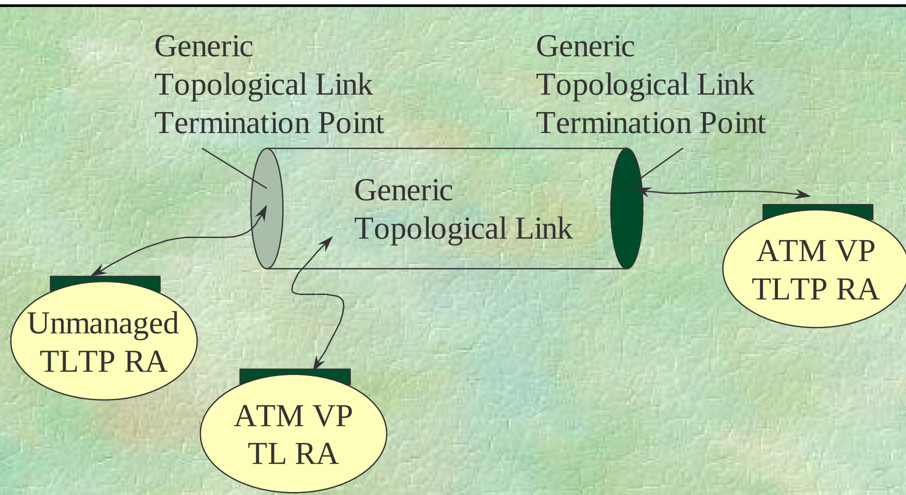

Business Stimulus: Add network interworking port
Layer X+2
Layer X+1
Layer X
Signal C
Signal B
Signal A
TLTP C
CTPs C
TTP C
TLTP B
CTPs B
TTP B
TLTP A
CTPs A
TTP A
Port A


Business Stimulus: Add Physical Link or Add Virtual Link
Layer Network A
Logical Connection
Physical Connection
E1
E2
Layer Network B

Extending Network Resources to include Business Specific Rules

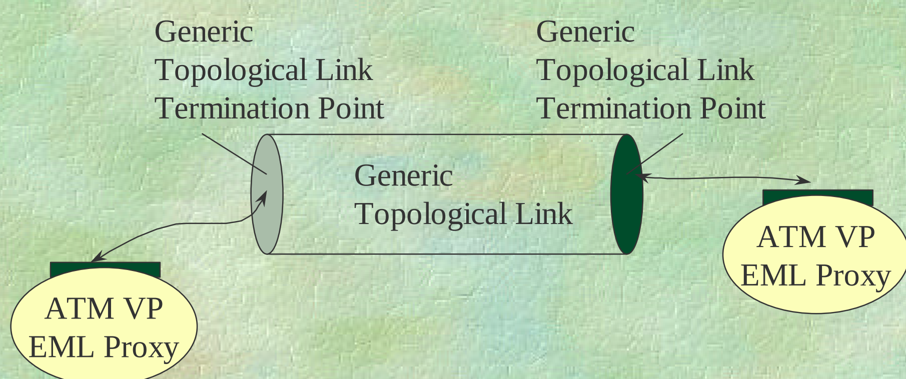
- **Extending Objects (increased information or behavior)**
  - Black-box extension (composition);
  - White-box extension (inheritance);
  - Reference comparing black-box extension and white box extension [Huni, Johnson, Engel]

- **Business rules in the network resources extensions**;
  - Bandwidth management
  - Address management
  - Element layer management



Business Extension: Bandwidth and Address Management

- Managed versus unmanaged
- Technology specific management rules
- Configurations for specific classes of service
- Constraints/Reservations for specific connections



Business Extension: Element Management Layer Proxies

- Proxies that are responsible to create/delete EML representations
- Mapping between TINA model and technology specific EML model
- Builds context on the element into which connections can be made and terminated on the element (CTP, TTP)

- **Conclusion**
  - This presentation represents only a small portion of the lessons learned and extensions made to the TINA NRA (due to time)
  - Connection Manager is in PRODUCTION with several releases complete and several releases planned
  - TINA NRA has been very helpful in providing a software blueprint for Connection Manager
  - We have defined and implemented a set of business stimuli that result in the creation, management, and deletion of network resources
  - We have defined and implemented a set of extensions needed in order to support the business specific rules for consumption of network resources