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# **The Telecommunications Management Network (TMN)**

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**Tutorial presented in the 2nd International Conference  
of Intelligence in Services & Networks (IS&N'94)**

**Aachen, Germany, 1994**

# TUTORIAL OUTLINE

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- ◆ **TMN SCOPE**
- ◆ **MANAGEMENT FUNCTIONAL AREAS**
- ◆ **TMN FUNCTIONAL, INFORMATION AND PHYSICAL ARCHITECTURES**
- ◆ **TMN LAYERED ARCHITECTURE**
- ◆ **TMN RECOMMENDATIONS AND PRODUCT STATUS**

# THE NEED FOR OPEN MANAGEMENT

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- ◆ **NEED TO PROVIDE TELECOMMUNICATION SERVICES GLOBALLY IN A COST-EFFECTIVE MANNER**
  - **MULTI-VENDOR, MULTI-PROVIDER ENVIRONMENT**
  
- ◆ **MANAGEMENT SYSTEMS ARE REQUIRED FOR OPERATION, ADMINISTRATION, MAINTENANCE AND PROVISIONING (OAM&P) ACTIVITIES**
  - **MANAGEMENT APPLICATIONS NEED TO COMMUNICATE OPENLY WITHIN A DOMAIN AND ACROSS DOMAINS**
  
- ◆ **NEED FOR MANAGEMENT FRAMEWORKS AND STANDARDS**

# WHAT IS THE TELECOMMUNICATIONS MANAGEMENT NETWORK (TMN)

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- ◆ **ITS PURPOSE IS TO SUPPORT OPERATORS IN MANAGING TELECOMMUNICATIONS NETWORKS AND SERVICES**
- ◆ **TO DO THAT IT PROVIDES A FRAMEWORK TO ACHIEVE INTERCONNECTION OF OPERATIONS SYSTEMS AND TELECOMMUNICATIONS EQUIPMENT**
- ◆ **THIS IS ACHIEVED THROUGH AN AGREED ARCHITECTURE WITH STANDARDISED PROTOCOLS AND INTERFACES**

# WHAT IS THE TMN (cont'd)

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- ◆ **SERIES OF ITU-T RECOMMENDATIONS (M.3xxx), BUILDING ON THE ISO/OSI SYSTEMS MANAGEMENT MODEL (X.700)**
  - **OTHER OSI APPLICATION SERVICES ARE ALSO USED (DIRECTORY, FILE TRANSFER, SECURITY, TRANSACTION PROCESSING)**
- ◆ **HIERARCHICAL LOGICAL LAYERED ARCHITECTURE**
- ◆ **RICH AND GENERAL ARCHITECTURAL FRAMEWORK**

# TMN FIELD OF APPLICATION

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- ◆ **SYNCHRONOUS TRANSMISSION NETWORKS (SDH/SONET)**
- ◆ **BROADBAND MULTI-SERVICE NETWORKS (ATM)**
- ◆ **PUBLIC SWITCHED TELEPHONE NETWORKS**
- ◆ **INTELLIGENT NETWORKS**
- ◆ **MOBILE NETWORKS**
- ◆ **etc.**

# MANAGEMENT FUNCTIONAL AREAS

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- ◆ **TYPES OF MANAGEMENT ACTIVITY HAVE BEEN CATEGORISED INTO FIVE GENERIC FUNCTIONAL AREAS:**
  - **FAULT MANAGEMENT.**
  - **CONFIGURATION MANAGEMENT.**
  - **ACCOUNTING MANAGEMENT.**
  - **PERFORMANCE MANAGEMENT.**
  - **SECURITY MANAGEMENT.**
  
- ◆ **ALSO KNOWN AS *FCAPS* FROM THEIR INITIALS.**

# FAULT MANAGEMENT

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- ◆ **RECEIVE REPORTS ABOUT MALFUNCTIONS (ALARMS).**
  - **PRIORITISE, CONDENSE, FILTER.**
- ◆ **ALARM CORRELATION, CONFIDENCE / DIAGNOSTIC TESTING.**
- ◆ **FAULT IDENTIFICATION AND DIAGNOSIS.**
- ◆ **MAINTENANCE DISPATCH.**
  - **PERIODIC TESTING / REPAIR ACTIVITIES.**
- ◆ **BYPASS FAULTS THROUGH SOFT RE-CONFIGURATION.**
  - **RELATIONSHIP WITH CONFIGURATION MANAGEMENT.**



# CONFIGURATION MANAGEMENT

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- ◆ **MAINTAIN THE CONFIGURATION STATE OF A NETWORK AND THE RELATIONSHIPS BETWEEN COMPONENTS.**
- ◆ **IDENTIFY STATUS AND LOCATION OF EQUIPMENT (INVENTORY).**
- ◆ **INITIALISE, CONFIGURE AND SHUT DOWN EQUIPMENT. MAINTAIN VIEW OF BOTH PHYSICAL AND LOGICAL NETWORK TOPOLOGY.**
- ◆ **SUPPORT SEMI-PERMANENT CONNECTIONS e.g. PERMANENT VIRTUAL CIRCUITS (PVCs).**
- ◆ **RELATIONSHIP WITH PLANNING, PERFORMANCE AND FAULT MANAGEMENT.**

# ACCOUNTING MANAGEMENT

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- ◆ **COLLECT SERVICE USAGE INFORMATION (“USAGE METERING”).**
- ◆ **ASSOCIATE IT WITH TARIFFING SCHEMES TO PRODUCE CHARGING AND BILLING INFORMATION.**
- ◆ **MONITOR USER ACCESS PRIVILEGES.**
- ◆ **PROVIDE ANALYSIS OF USAGE FOR SALES, NEW TARIFFING POLICIES, etc.**

# PERFORMANCE MANAGEMENT

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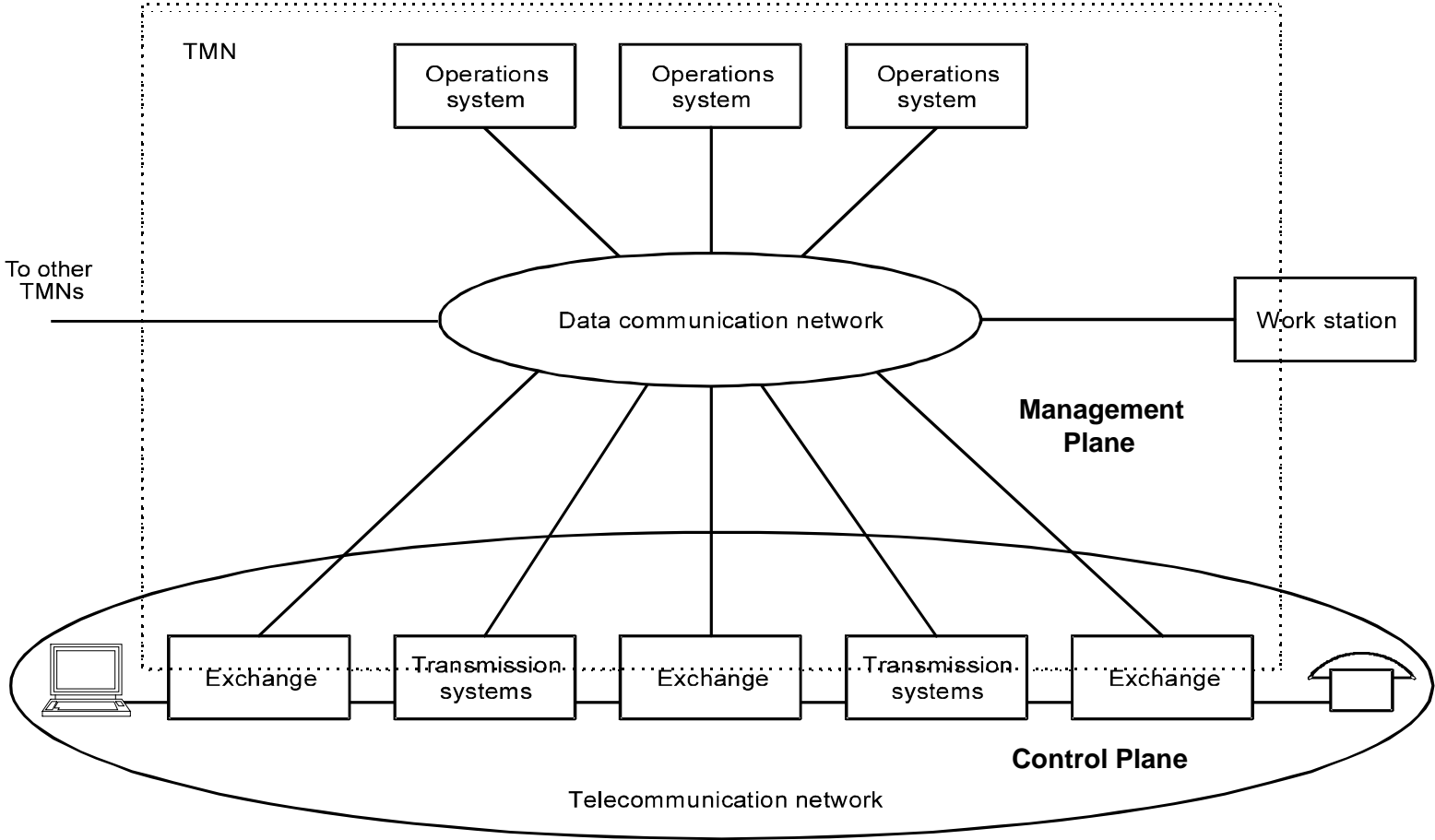
- ◆ **COLLECT TRAFFIC INFORMATION**
- ◆ **USE IT FOR CAPACITY PLANNING AND PROVIDE TRAFFIC FLOW PREDICTIONS (PER HOUR, DAY, MONTH).**
- ◆ **MONITOR THE LEVEL OF RESOURCE UTILISATION AND RESPONSE TIMES.**
- ◆ **IDENTIFY BOTTLENECKS AND CONGESTION, TRY TO RECOVER THROUGH SOFT RE-CONFIGURATION.**
  - **RELATIONSHIP WITH CONFIGURATION MANAGEMENT.**
- ◆ **MONITOR QUALITY OF SERVICE FOR SERVICES SOLD ON SERVICE LEVEL AGREEMENTS.**

# SECURITY MANAGEMENT

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- ◆ **PROTECT ACCESS TO NETWORK, SYSTEM, SERVICE AND MANAGEMENT RESOURCES.**
- ◆ **AUTHENTICATION: VALIDATE LEGITIMATE USERS AND APPLICATIONS.**
- ◆ **CONFIDENTIALITY: ENCRYPT CONFIDENTIAL INFORMATION WHILE IN TRANSIT.**
- ◆ **INTEGRITY: PREVENT MODIFICATION OF INFORMATION WHILE IN TRANSIT.**
- ◆ **ACCESS CONTROL: PROVIDE DIFFERENT LEVELS OF ACCESS TO DIFFERENT USERS / APPLICATIONS.**

# TMN RELATIONSHIP TO A TELECOM NETWORK



# BASIC TMN OBJECTIVES

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- ◆ **GENERIC OBJECT-ORIENTED MANAGEMENT MODELS**
  - **MANAGEMENT OF DIVERSE EQUIPMENT THROUGH STANDARD INTERFACES**
- ◆ **DISTRIBUTED FUNCTIONALITY**
- ◆ **SECURITY AND DATA INTEGRITY**

# TMN FUNCTIONALITY

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- ◆ **MANAGEMENT INFORMATION EXCHANGE**
  - WITH ELEMENTS, INTRA- AND INTER-TMN
- ◆ **INFORMATION CONVERSION AND ABSTRACTION**
- ◆ **ANALYSE INFORMATION AND REACT APPROPRIATELY**
- ◆ **PRESENT INFORMATION TO THE USER IN A MEANINGFUL FORM**
- ◆ **ENSURE SECURE ACCESS TO MANAGEMENT INFORMATION**

# ARCHITECTURAL REQUIREMENTS

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- ◆ **MINIMISE REACTION TIMES TO NETWORK EVENTS**
- ◆ **MINIMISE LOAD CAUSED BY MANAGEMENT TRAFFIC**
- ◆ **ALLOW FOR GEOGRAPHIC DISPERSION OF CONTROL**
- ◆ **PROVIDE ISOLATION MECHANISMS FOR FAULTS**
- ◆ **IMPROVE SERVICE ASSISTANCE AND INTERACTION WITH CUSTOMERS**



# TMN ARCHITECTURES

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- ◆ **TMN FUNCTIONAL ARCHITECTURE**
- ◆ **TMN INFORMATION ARCHITECTURE**
- ◆ **TMN PHYSICAL ARCHITECTURE**

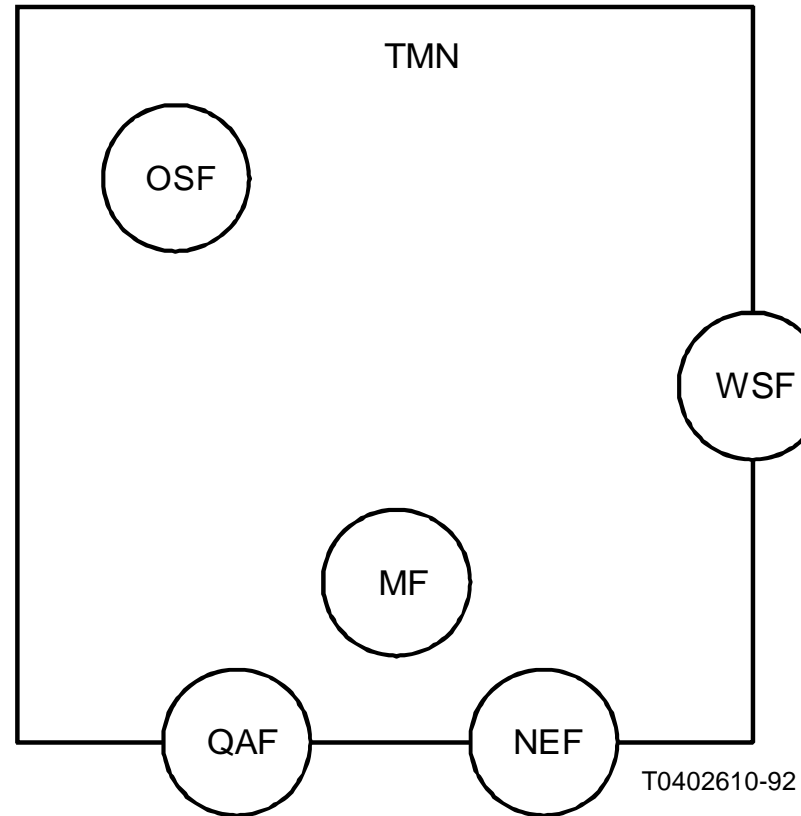
# TMN FUNCTIONAL ARCHITECTURE

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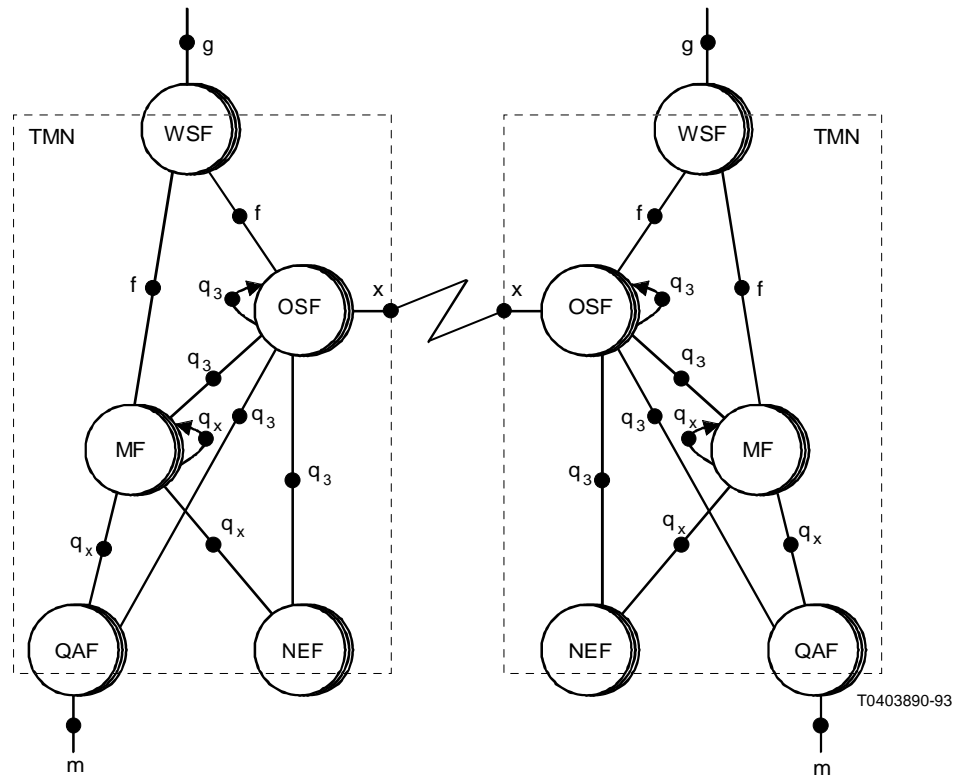
- ◆ **THE TMN FUNCTIONAL ARCHITECTURE DEFINES:**
  - **THE TYPES OF FUNCTION BLOCKS THAT MAY BE PRESENT IN A TMN**
  - **THE TYPES OF REFERENCE POINTS INTERCONNECTING THEM**
  - **THE FUNCTIONAL COMPONENTS THAT MAY BE PRESENT IN EACH FUNCTION BLOCK**
  
- ◆ **NETWORK ELEMENT, Q-ADAPTOR, MEDIATION, OPERATIONS SYSTEM AND WORKSTATION FUNCTION BLOCKS**

# TMN FUNCTION BLOCKS

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# TMN REFERENCE POINTS



# TMN FUNCTIONAL COMPONENTS

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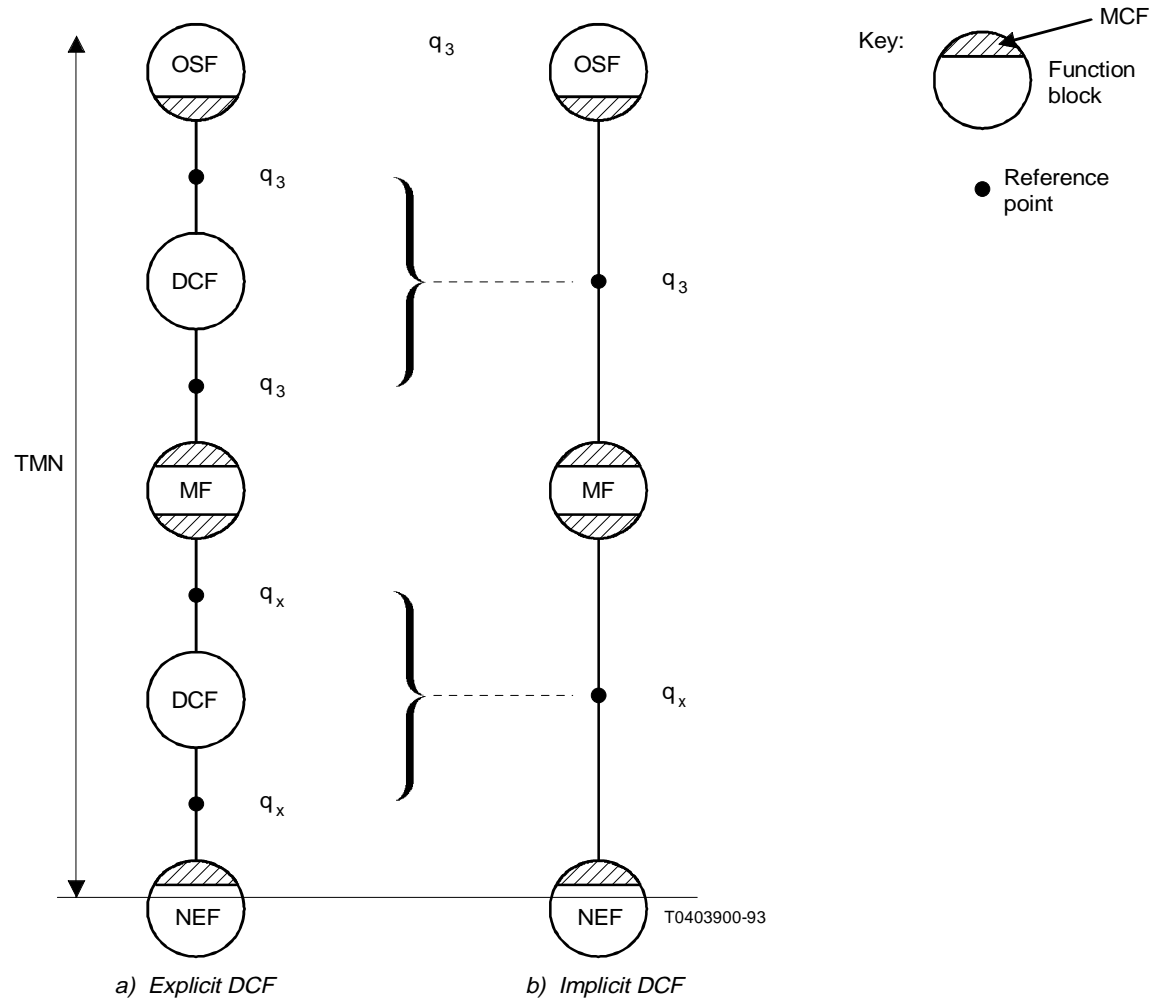
- ◆ **MANAGEMENT APPLICATION FUNCTION (MAF)**
  - OSF, MF, QAF and NEF MAFs
- ◆ **INFORMATION CONVERSION FUNCTION (ICF)**
- ◆ **WORKSTATION SUPPORT FUNCTION (WSSF)**
- ◆ **USER INTERFACE SUPPORT FUNCTION (UISF)**
- ◆ **MESSAGE COMMUNICATION FUNCTION (MCF)**
- ◆ **SECURITY FUNCTION (SF)**

# RELATIONSHIP OF FUNCTION BLOCKS AND FUNCTIONAL COMPONENTS

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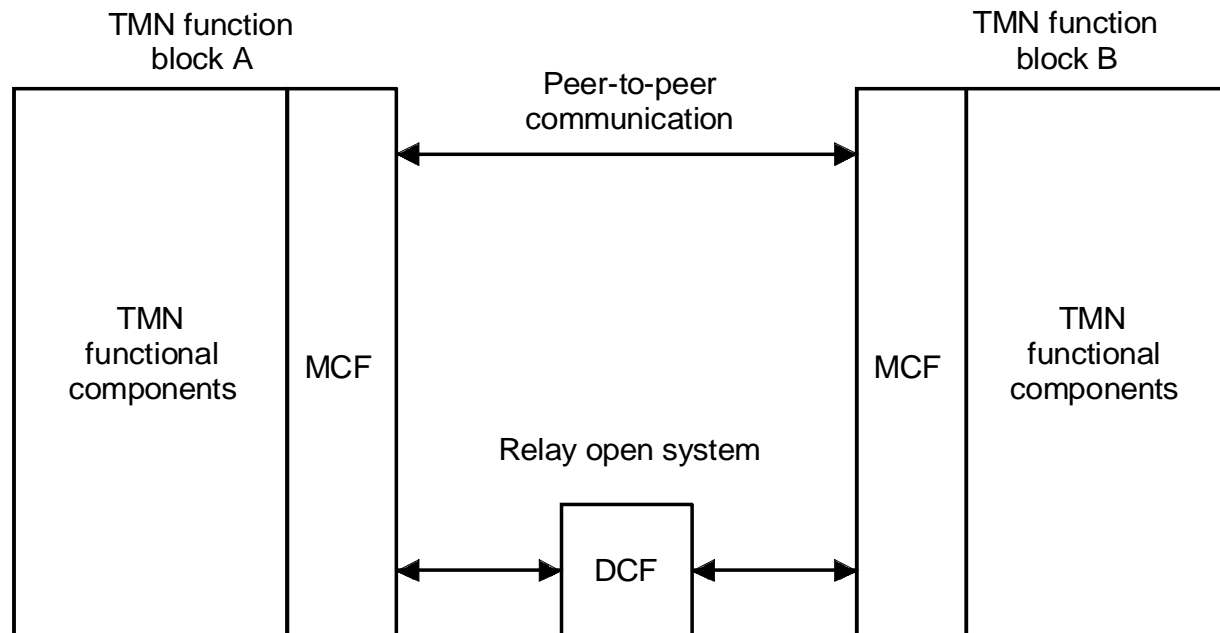
Function block	Functional components	Associated message communications functions
OSF	OSF-MAF(A/M), WSSF, ICF, SF	MCF <sub>x</sub> , MCF <sub>q3</sub> , MCF <sub>f</sub>
WSF	UIFS, SF	MCF <sub>f</sub>
NEF <sub>q3</sub>	NEF-MAF(A), SF	MCF <sub>q3</sub>
NEF <sub>qx</sub>	NEF MAF(A), SF	MCF <sub>qx</sub>
MF	MF-MAF(A/M), ICF, SF	MCF <sub>q3</sub> MCF <sub>qx</sub> , MCF <sub>f</sub>
QAF <sub>q3</sub>	QAF-MAF(A/M), ICF, SF	MCF <sub>q3</sub> MCF <sub>m</sub>
QAF <sub>qx</sub>	QAF-MAF(A/M), ICF, SF	MCF <sub>qx</sub> MCF <sub>m</sub>

# THE TMN DATA COMMUNICATION FUNCTION



# MESSAGE AND DATA COMMUNICATION FUNCTION

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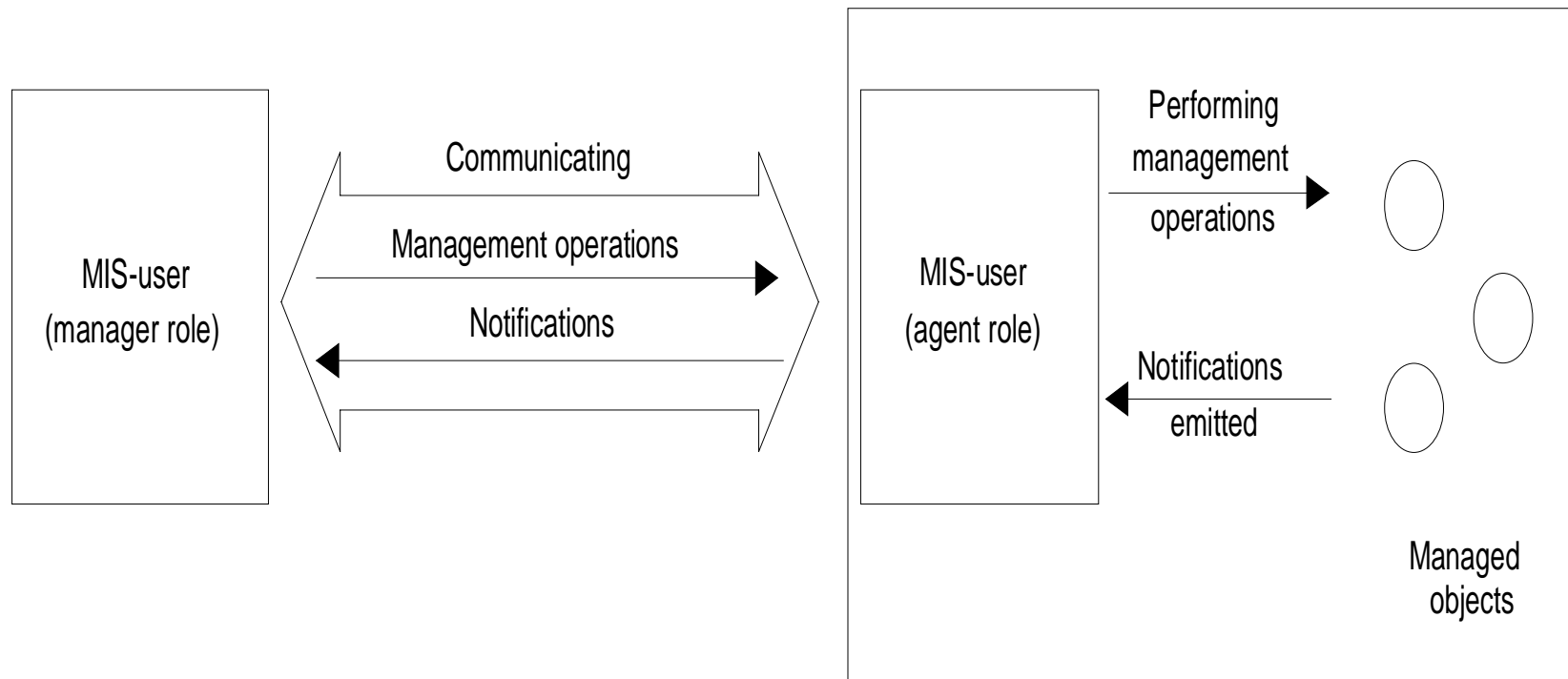
# TMN INFORMATION ARCHITECTURE

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- ◆ **RESOURCES ARE MODELLED USING OBJECT-ORIENTED CONCEPTS AT DIFFERENT LEVELS OF ABSTRACTION**
- ◆ **BASED ON THE MANAGER-AGENT MODEL**
- ◆ **RE-USES OSI SYSTEMS MANAGEMENT (X.700) CONCEPTS**

# THE MANAGER-AGENT MODEL

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# MANAGED OBJECTS

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- ◆ **ABSTRACTIONS OF PHYSICAL OR LOGICAL RESOURCES TO BE MANAGED**
- ◆ **ENCAPSULATE THE UNDERLYING REAL RESOURCE**
- ◆ **ENABLE ITS MANIPULATION THROUGH WELL DEFINED OPERATIONS**
- ◆ **EXHIBIT BEHAVIOUR AT THE OBJECT BOUNDARY, HIDING RESOURCE ACCESS DETAILS**

# SUPPORT MANAGED OBJECTS

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- ◆ **NOT ALL MANAGED OBJECTS REPRESENT RESOURCES**
- ◆ **THERE ARE MANAGED OBJECTS THAT EXIST FOR THE NEEDS OF THE MANAGEMENT SYSTEM ITSELF**
- ◆ **EXAMPLES ARE THOSE THAT CONTROL NOTIFICATIONS, LOGGING, ACCESS CONTROL etc.**

# THE MANAGEMENT INFORMATION BASE (MIB)

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- ◆ A VIRTUAL INFORMATION STORE COMPRISING ALL MANAGED OBJECTS IN A TMN
- ◆ A HIGHLY DISTRIBUTED OBJECT-ORIENTED DATABASE OF DYNAMIC NATURE
- ◆ MOs ARE “LIVING” ENTITIES, REFLECTING THE STATE OF THE REAL RESOURCE THEY ENCAPSULATE
- ◆ EACH TMN APPLICATION IN AGENT ROLE HANDLES A PART OF IT

# THE INFORMATION MODEL

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- ◆ **GDMO - GUIDELINES FOR THE DEFINITION OF MANAGED OBJECTS, ABSTRACT O-O SPECIFICATION LANGUAGE**
- ◆ **MANAGED OBJECT OPERATIONS:**
  - **GET, SET (APPLY TO THE OBJECT'S ATTRIBUTES)**
  - **ACTION, CREATE, DELETE (APPLY TO THE OBJECT)**
  - **NOTIFICATION (EMITTED BY THE OBJECT)**
- ◆ **POWERFUL FULLY O-O INFORMATION FRAMEWORK, CAN MAP TO O-O PROGRAMMING LANGUAGES (e.g. C++)**
- ◆ **ASN.1 - SPECIFIES THE STRUCTURE OF ATTRIBUTE, ACTION, NOTIFICATION AND MO SPECIFIC ERROR VALUES**

# THE MANAGEMENT SERVICE / PROTOCOL

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- ◆ **CMIS/P - COMMON MANAGEMENT INFORMATION SERVICE / PROTOCOL**
- ◆ **CONNECTION ORIENTED RELIABLE COMMUNICATION - REQUIRES FULL OSI STACK**
- ◆ **MANAGEMENT OPERATIONS:**
  - **CONNECT, DISCONNECT, ABORT (ASSOCIATION)**
  - **GET, SET, ACTION, CREATE, DELETE, EVENT-REPORT, CANCEL-GET (TO/BY OBJECT OR TO THE AGENT)**
- ◆ **MULTIPLE OBJECT ACCESS THROUGH SCOPING, FILTERING, SYNCHRONISATION - OFFERED BY THE AGENT**

# EVENT-BASED OPERATION

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- ◆ **SOPHISTICATED SUPPORT FOR EVENT-BASED OPERATION**
- ◆ **EVENT REPORTING AND LOGGING FACILITIES**
- ◆ **EVENT FORWARDING DISCRIMINATORS AND LOG SUPPORT MOs CONTROLLED BY MANAGERS**
- ◆ **VERY FINE GRANULARITY BY FILTERING ON ATTRIBUTE VALUES OF THE POTENTIAL EVENT**
- ◆ **LOGGING PROVIDES REMOTE “STANDARD” STORAGE OF SIGNIFICANT EVENTS**



# SYSTEMS MANAGEMENT FUNCTIONS

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- ◆ **GENERIC MANAGEMENT FUNCTIONALITY OFFERED BY MANAGED SYSTEMS (AGENTS)**
- ◆ **STANDARDISE COMMON FUNCTIONS THAT MAY BE REUSED**
- ◆ **OBVIATE THE USE OF SPECIFIC INFORMATION MODELS BY PROVIDING GENERIC FUNCTIONALITY**
- ◆ **CAN BE USED TO PROVIDE GENERIC MANAGER APPLICATIONS (CONFIGURATION, ALARM, PERFORMANCE etc.)**

# SYSTEMS MANAGEMENT FUNCTIONS (cont'd)

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X.730   10164-1	Object Management Function
X.731   10164-2	State Management Function
X.732   10164-3	Attributes for Representing Relationships
X.733   10164-4	Alarm Reporting Function
X.734   10164-5	Event Management Function
X.735   10164-6	Log Control Function
X.736   10164-7	Security Alarm Reporting Function
X.740   10164-8	Security Audit Trail Function
X.741   10164-9	Objects and Attributes for Access Control
X.742   10164-10	Accounting Meter Function
X.739   10164-11	Metric Objects and Attributes
X.745   10164-12	Test Management Function
X.738   10164-13	Summarisation Function
X.737   10164-14	Confidence and Diagnostic Testing
X.746   10164-15	Scheduling Function
X.750   10164-16	Management Knowledge Management Function

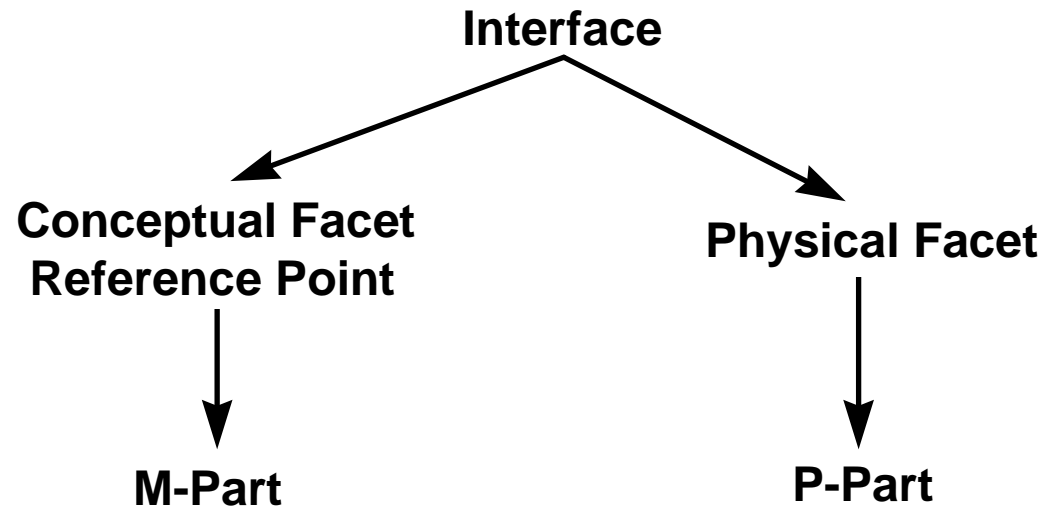
# TMN PHYSICAL ARCHITECTURE

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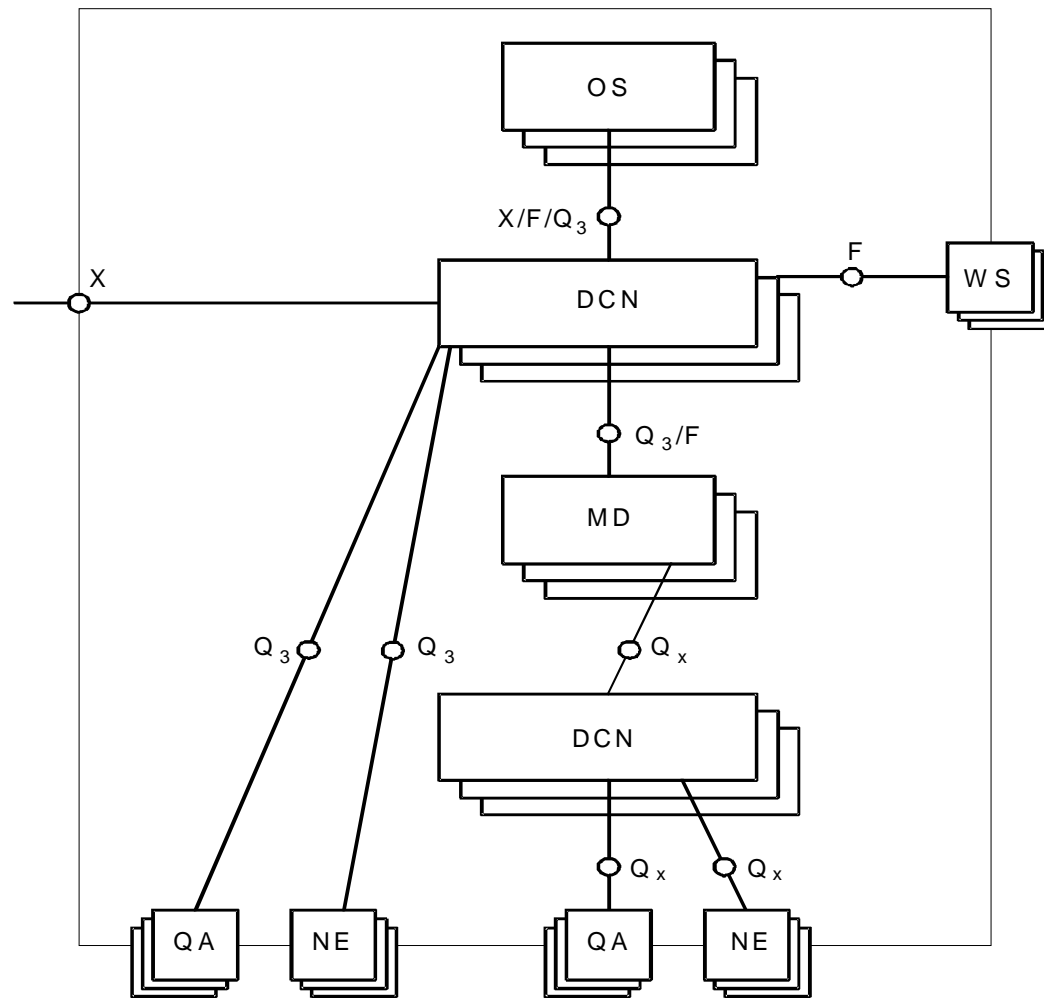
- ◆ **IN THE TMN PHYSICAL ARCHITECTURE:**
  - **FUNCTION BLOCKS BECOME PHYSICAL BLOCKS**
  - **REFERENCE POINTS BECOME INTEROPERABLE INTERFACES**
  
- ◆ **PHYSICAL BLOCKS RESIDE IN TMN NODES WHICH ARE CONNECTED THROUGH THE DATA COMMUNICATION NETWORK**

# INTEROPERABLE REFERENCE POINTS AND INTERFACES

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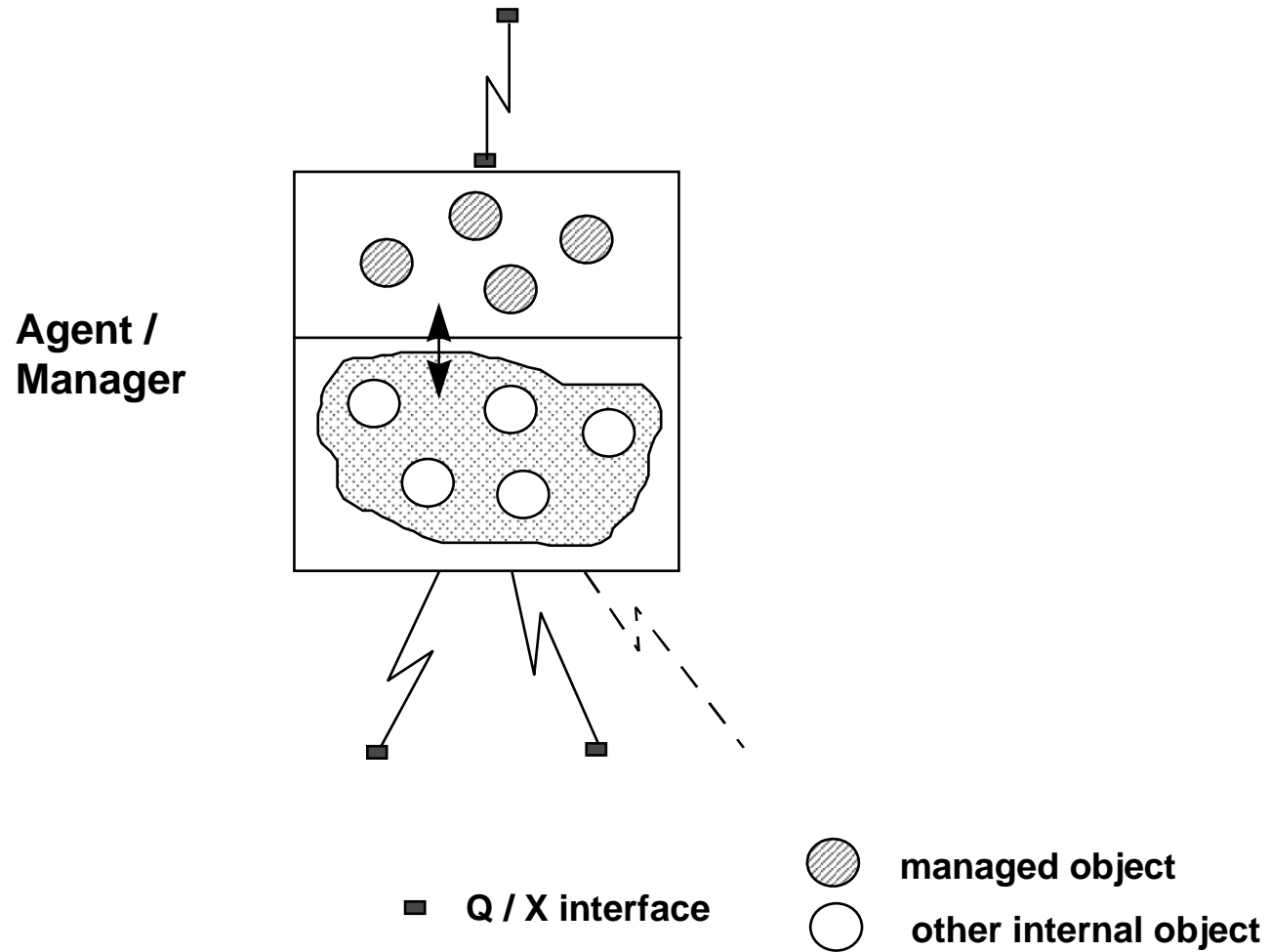


# EXAMPLE TMN PHYSICAL ARCHITECTURE



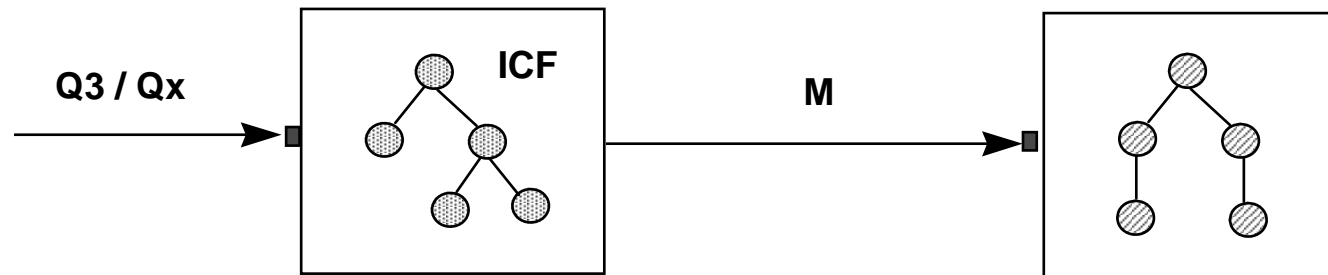
# OPERATIONS SYSTEMS

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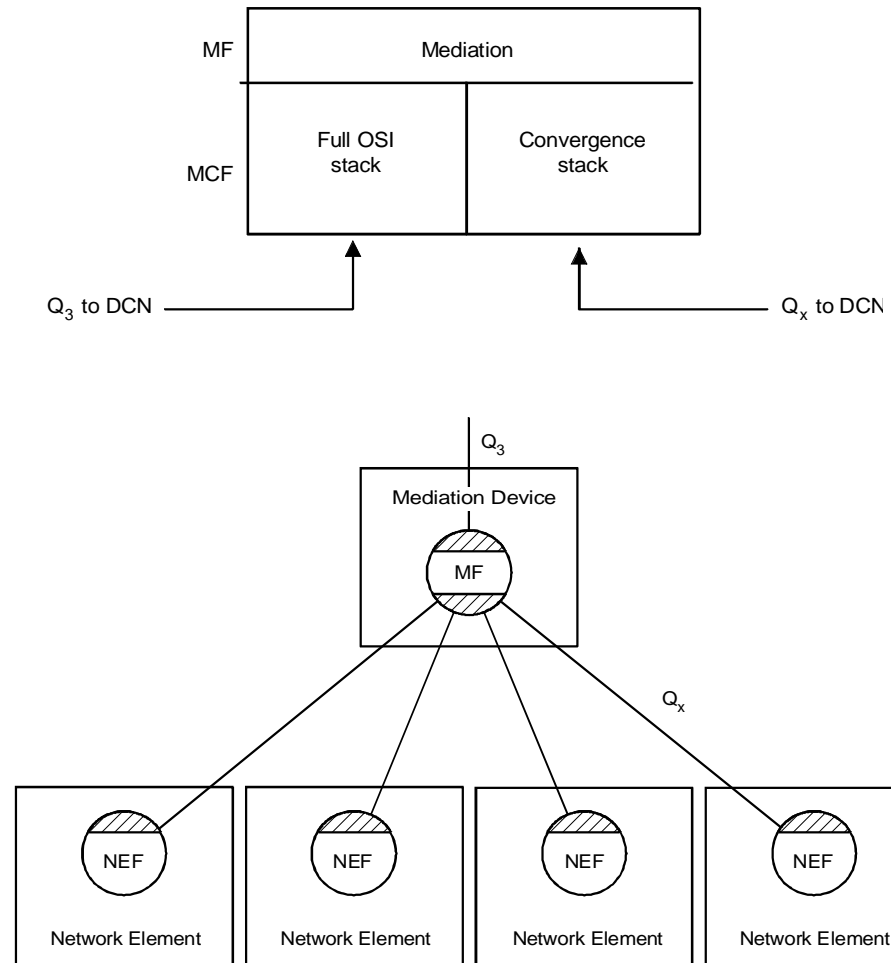
# Q-ADAPTORS

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# MEDIATION DEVICES

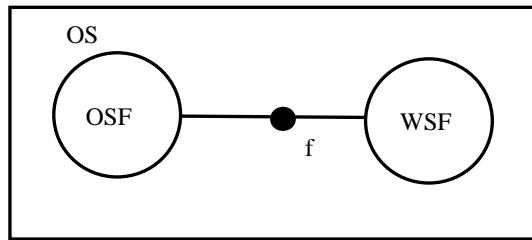
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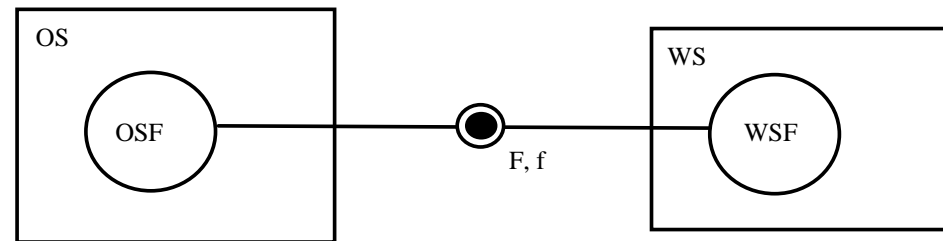


# WORKSTATIONS

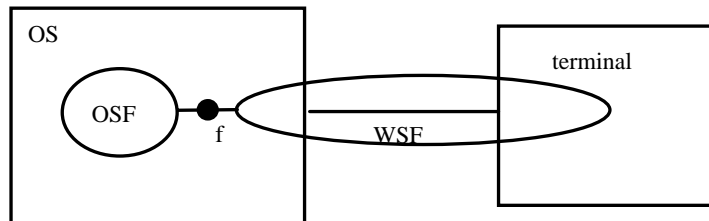
a.



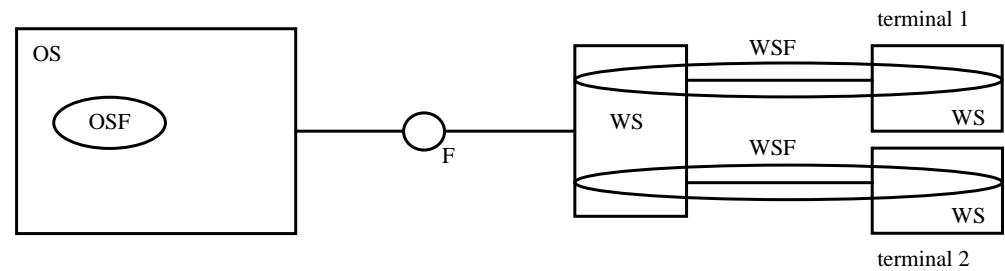
b.



c.



d.



# TMN INTEROPERABLE INTERFACES

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- ◆ **MAKE POSSIBLE TO MANAGE A MULTI-VENDOR, MULTI-CAPABILITY NETWORK**
- ◆ **AN INTERFACE IS DEFINED BY A PROTOCOL SUITE AND A SET OF MESSAGES**
- ◆ **MESSAGES IN TRANSACTION-ORIENTED INTERFACES MANIPULATE OBJECTS, HENCE**
- ◆ **INTERFACE = PROTOCOL STACK + OBJECT MODEL**
- ◆ **SHARED MANAGEMENT KNOWLEDGE ENSURES THAT EACH END UNDERSTANDS THE EXACT MESSAGE MEANING**

# TMN INTERFACE SPECIFICATION

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- ◆ **TMN MANAGEMENT SERVICES ARE DECOMPOSED TOP-DOWN TO RESULT IN INTERFACE SPECIFICATIONS**
  - TMN MANAGEMENT SERVICE
  - TMN MANAGEMENT SERVICE COMPONENT
  - TMN MANAGEMENT FUNCTION
  - TMN MANAGEMENT FUNCTION SET
  
- ◆ **MANAGEMENT FUNCTIONS ARE USED FOR OBJECT MODELLING AND RESULT IN TMN INTERFACE MODELS**

# TMN INTERFACE REALISATION

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- ◆ **Q3 - CMIS/P, FTAM**
- ◆ **Qx - Q3 WITHOUT FULL CAPABILITIES**
- ◆ **X - SAME AS Q3 BUT NEEDS NECESSARILY SECURITY**
- ◆ **M - NON-OSI MANAGEMENT PROTOCOLS e.g. SNMP (OUTSIDE THE TMN)**
- ◆ **F - NOT YET IDENTIFIED**
- ◆ **G - THE WS GUI SPECIFICATION (OUTSIDE THE TMN)**

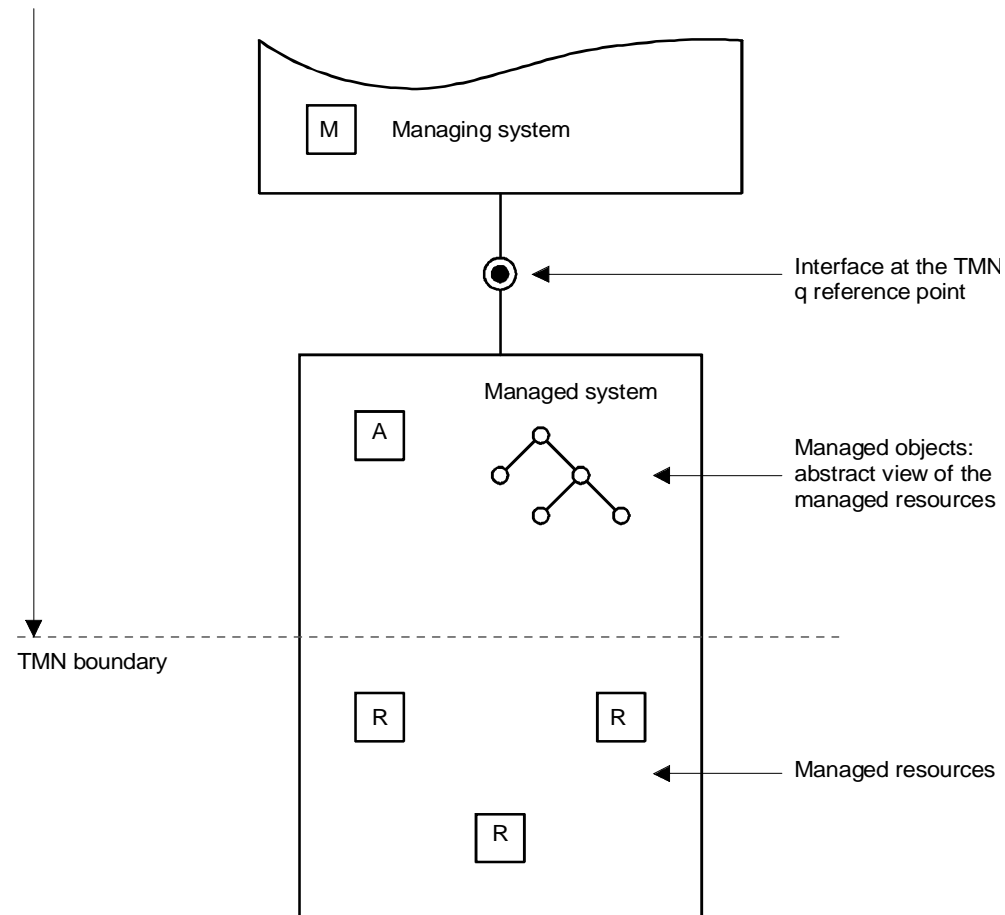
# TMN LAYERED ARCHITECTURE

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- ◆ **A KEY TMN CHARACTERISTIC IS ITS LAYERED ARCHITECTURE**
- ◆ **OPERATIONS SYSTEMS ARE STRUCTURED HIERARCHICALLY, WITH EACH LAYER BUILDING ON THE SERVICES OF THE LAYER BELOW (AS IN THE OSI-RM)**
- ◆ **SEPARATION OF CONCERNS AND ENCAPSULATION OF LOWER LEVEL FUNCTIONALITY**

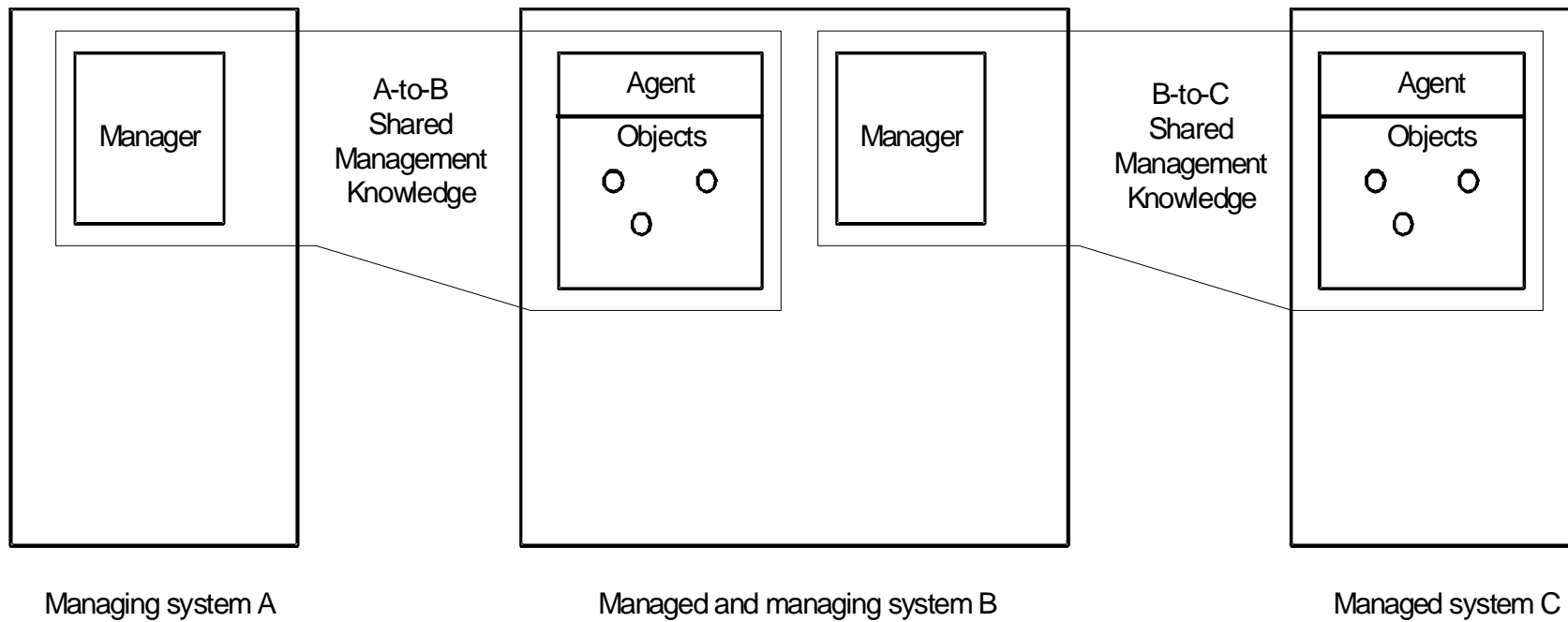
# RELATIONSHIP BETWEEN MANAGED OBJECTS AND REAL RESOURCES

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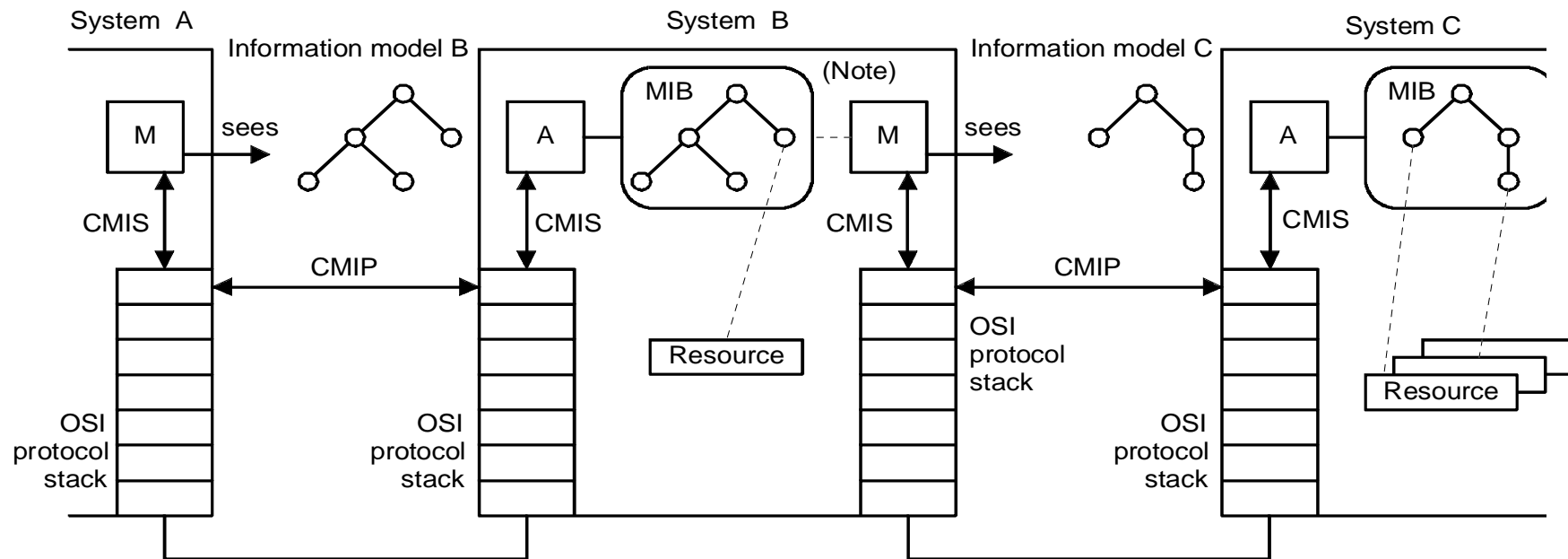


# SHARED MANAGEMENT KNOWLEDGE

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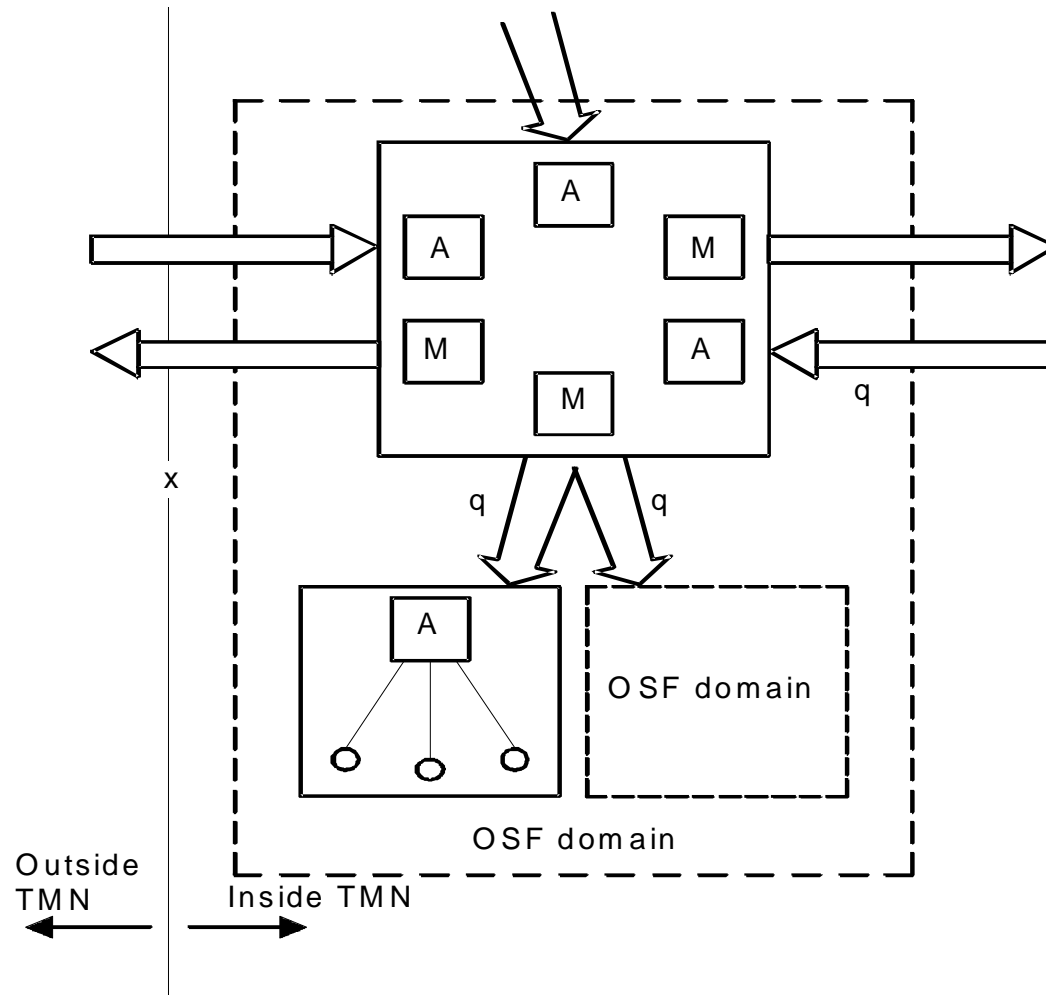


# CASCADED MANAGER / AGENT INTERACTIONS



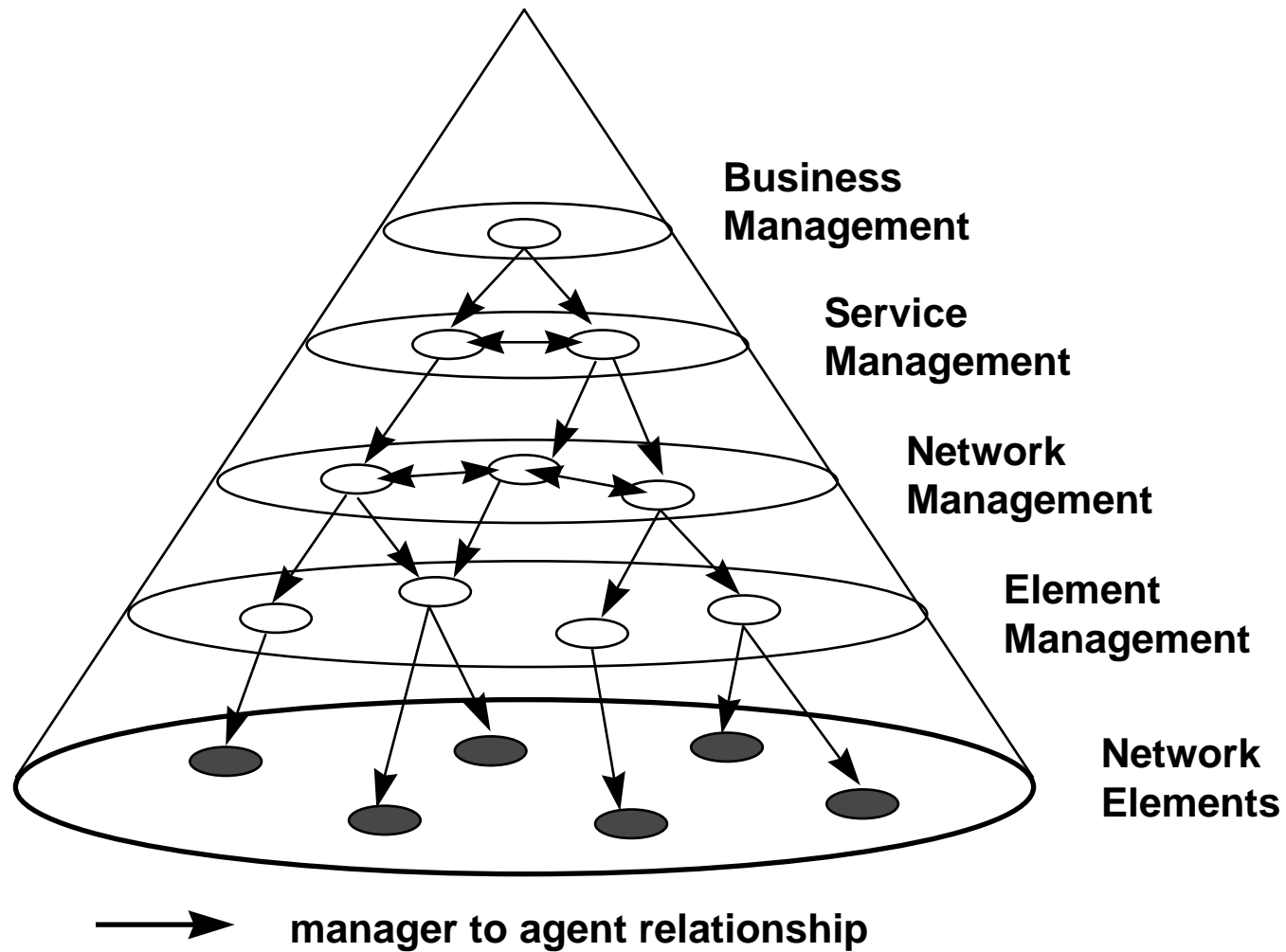


# LOGICAL LAYERED ARCHITECTURE



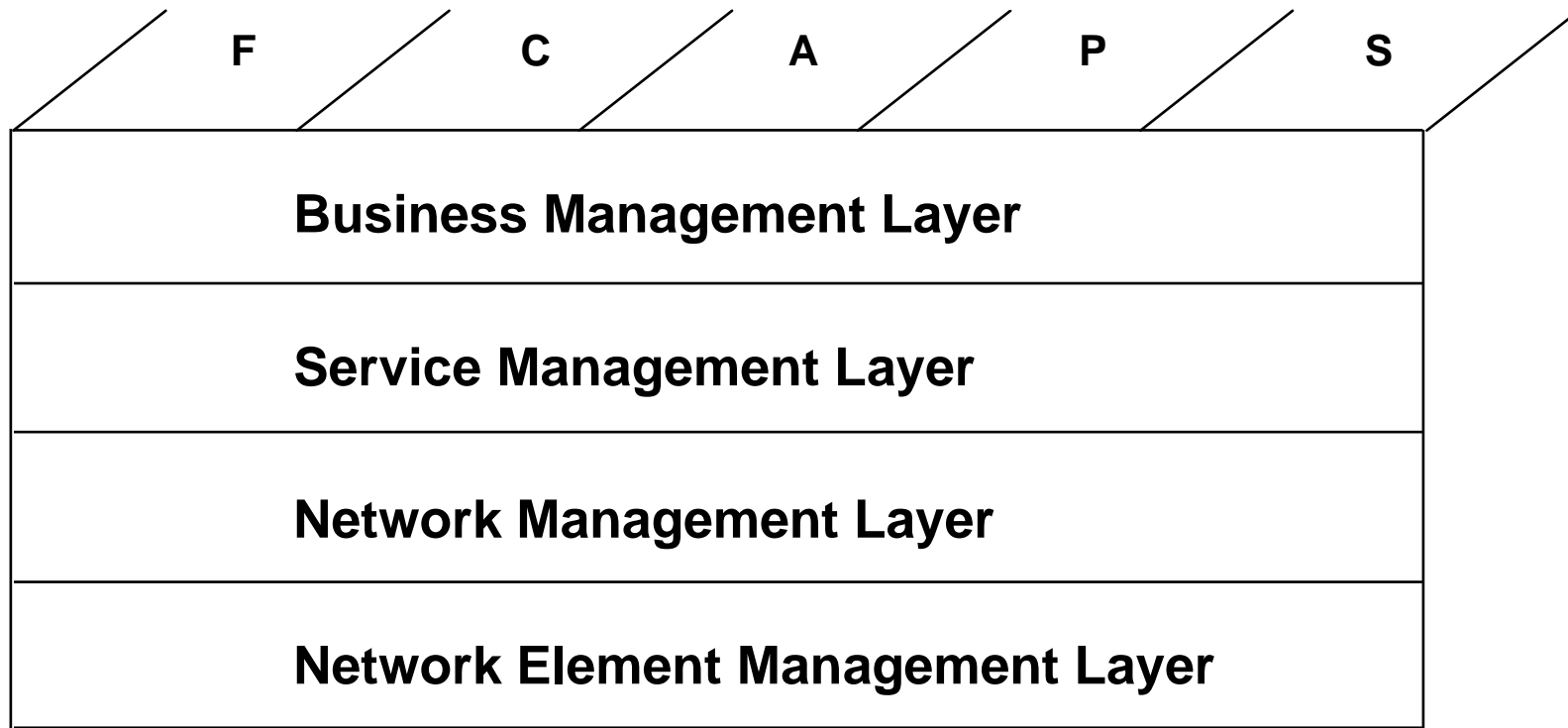
# EXAMPLE TMN LAYERED MODEL

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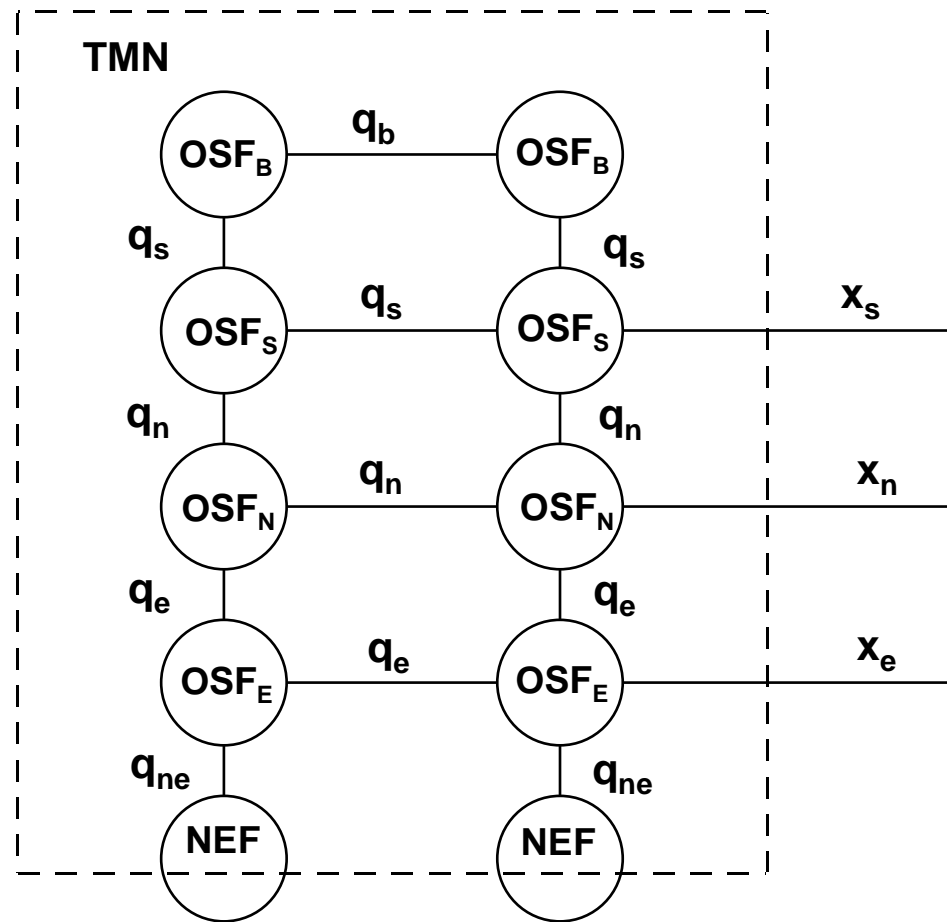


# TMN LAYERS AND FUNCTIONAL AREAS

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# CLASSES OF $q$ AND $x$ REFERENCE POINTS



# THE NETWORK ELEMENT MANAGEMENT LAYER

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- ◆ **COMPRISES A SET OF ELEMENT MANAGEMENT OSFs**
- ◆ **THESE CONTROL AND COORDINATE A SUBSET OF ELEMENTS**
- ◆ **ALLOW THE NETWORK LAYER TO ACCESS THEM**
- ◆ **MAINTAIN ELEMENT RELATED DATA**
- ◆ **PROVIDE AN ABSTRACTION OF THE SERVICES PROVIDED TO THE NETWORK LAYER (UNIFIED VIEW)**

# THE NETWORK MANAGEMENT LAYER

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- ◆ **CONTROLS AND COORDINATES NETWORK ELEMENTS WITHIN ITS SCOPE**
- ◆ **PROVIDES, CEASES, OR MODIFIES THE NETWORK CAPABILITIES FOR SERVICE PROVISION**
- ◆ **MAINTAIN THE NETWORK CAPABILITIES**
- ◆ **INTERACTS WITH THE SERVICE MANAGEMENT LAYER**

# THE SERVICE MANAGEMENT LAYER

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- ◆ **CUSTOMER FACING - SERVICE PROVISION, CESSATION, QoS etc.**
- ◆ **INTERACTION WITH THE SERVICE PROVIDERS**
- ◆ **INTERACTION BETWEEN SERVICES**
- ◆ **MAINTAINING STATISTICAL DATA**
- ◆ **INTERACTION WITH THE NETWORK AND BUSINESS MANAGEMENT LAYERS**

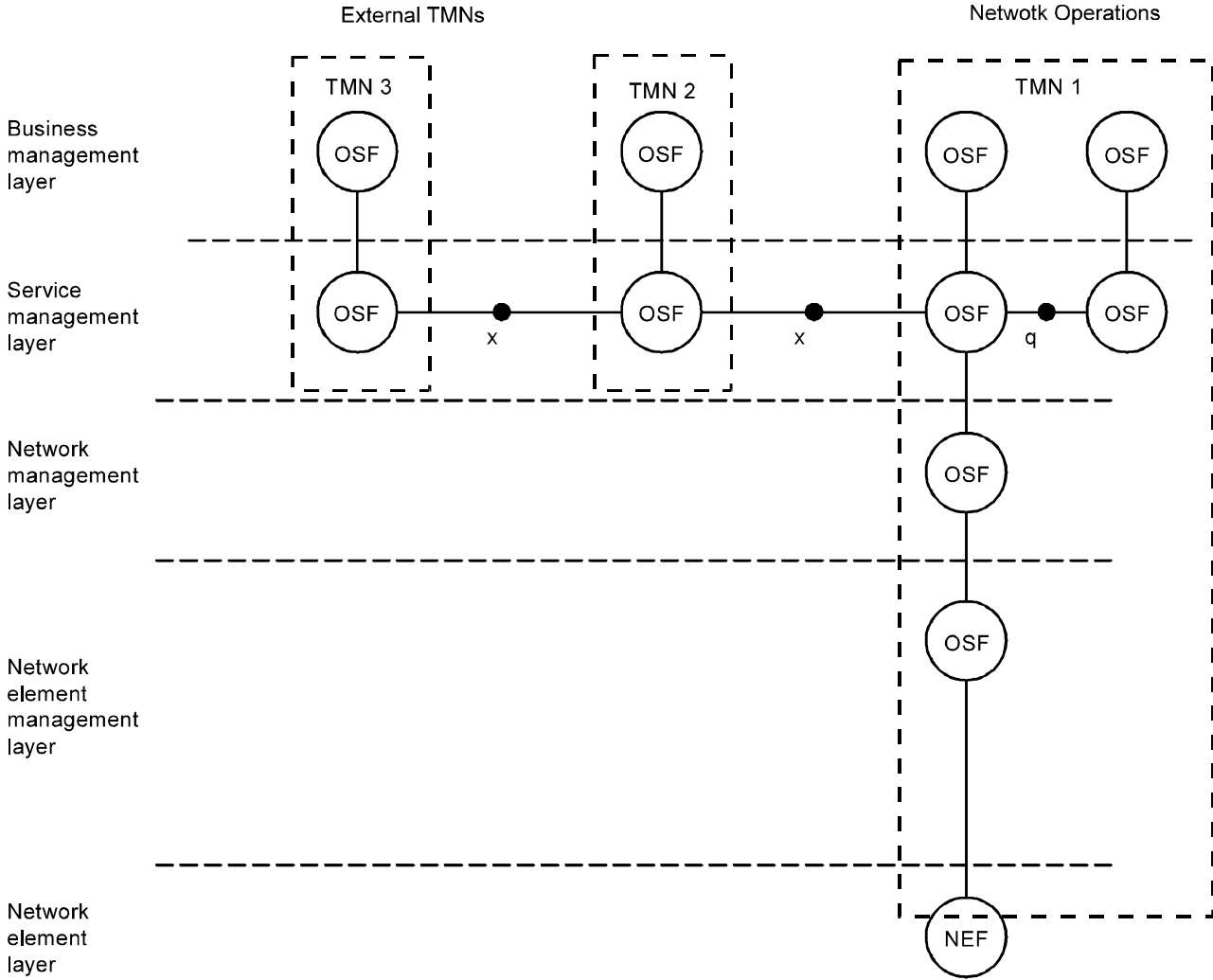
# THE BUSINESS MANAGEMENT LAYER

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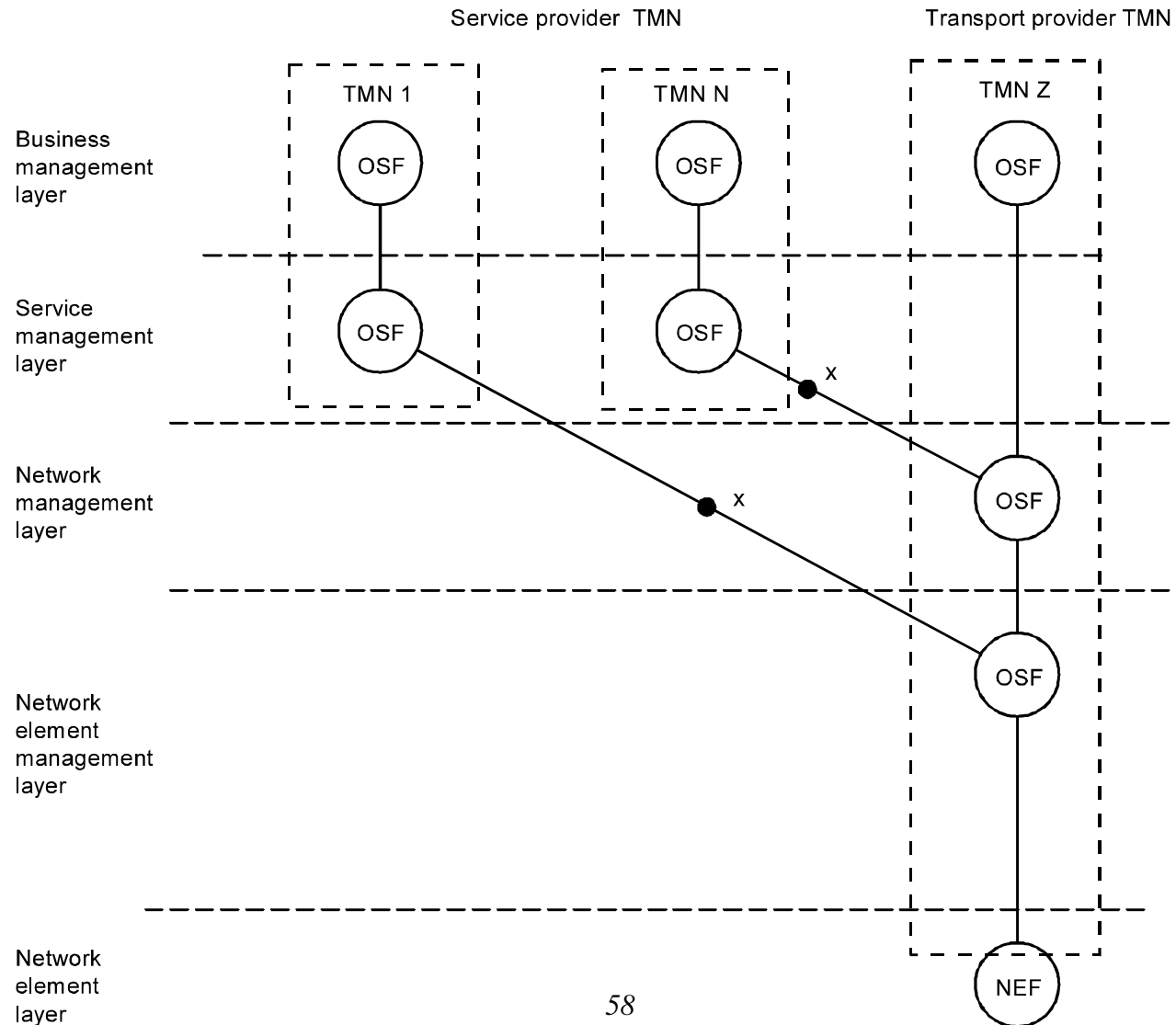
- ◆ **RESPONSIBILITY FOR THE TOTAL ENTERPRISE**
- ◆ **ITS FUNCTIONALITY IS TYPICALLY PROPRIETARY**
  - **NO X INTERFACE SUPPORTED**
- ◆ **SETS GOALS RATHER THAN GOAL ACHIEVEMENT**  
**(WHAT RATHER THAN HOW)**



# TMN INTERACTIONS - EXAMPLE 1



# TMN INTERACTIONS - EXAMPLE 2



# ITU-T TMN RECOMMENDATIONS

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- ◆ **M.3010 - PRINCIPLES FOR A TELECOMMUNICATIONS MANAGEMENT NETWORK**
- ◆ **M.3020 - TMN INTERFACE SPECIFICATION METHODOLOGY**
- ◆ **M.3100 - GENERIC NETWORK INFORMATION MODEL**
- ◆ **M.3180 - CATALOGUE OF TMN MANAGEMENT INFORMATION**
- ◆ **M.3200 - TMN MANAGEMENT SERVICES - OVERVIEW**
- ◆ **M.3300 - TMN CAPABILITIES PRESENTED AT THE F INTERFACE**
- ◆ **M.3400 - TMN MANAGEMENT FUNCTIONS**

# GENERIC NETWORK INFORMATION MODEL

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- ◆ **THE M.3100 GENERIC NETWORK INFORMATION MODEL IDENTIFIES OBJECT CLASSES THAT ARE :**
  - **COMMON TO MANAGED TELECOMMUNICATIONS NETWORKS**
  - **OF A GENERIC TYPE FOR TECHNOLOGY INDEPENDENT MANAGEMENT**
  - **ARE SUPER-CLASSES OF TECHNOLOGY SPECIFIC MANAGED OBJECTS**
  - **MANAGEMENT SUPPORT OBJECTS.**
  
- ◆ **SPECIALISATION YIELDS TECHNOLOGY-SPECIFIC INFORMATION MODELS**

# ISO/ITU-T OSI-SM RECOMMENDATIONS

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- ◆ **X.701 - SYSTEMS MANAGEMENT OVERVIEW**
- ◆ **X.710, X.711 - CMIS / CMIP**
- ◆ **X.720, X.721, X.722 - MANAGEMENT INFORMATION MODEL**
- ◆ **X.730 to X.750 - SYSTEMS MANAGEMENT FUNCTIONS**

# TMN PRODUCT STATUS

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- ◆ **TMN PRODUCTS ARE MOSTLY SOFTWARE PLATFORMS FOR BUILDING TMN APPLICATIONS**
- ◆ **A MARKET OF PRODUCTS (e.g. OSs, WSs) WILL APPEAR AS SOON AS INFORMATION MODELS ARE STANDARDISED**
- ◆ **CURRENTLY FOCUS IS IN NETWORK ELEMENTS FOR VARIOUS NETWORK TECHNOLOGIES**

# TMN PLATFORM REQUIREMENTS

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- ◆ **GDMO/ASN.1 COMPILER SUPPORT**
- ◆ **GENERIC OSI AGENT / MANAGER INFRASTRUCTURE AND SUPPORT FOR AGENT LOCATION TRANSPARENCY**
- ◆ **GRAPHICAL USER INTERFACE SUPPORT**
- ◆ **GENERIC APPLICATIONS (MIB BROWSER, FAULT, PERFORMANCE, CONFIGURATION, ALARM, LOGGING etc.)**
- ◆ **INTEGRATION WITH SNMP (e.g. THROUGH GENERIC Q-ADAPTORS)**

# SUMMARY

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- ◆ **THE TMN IS A RICH AND GENERAL ARCHITECTURAL FRAMEWORK FOR OPEN HIERARCHICAL MANAGEMENT**
- ◆ **POWERFUL CONCEPTS ENABLE TO HARNESS THE CAPABILITIES OF EMERGING BROADBAND MULTI-SERVICE NETWORKS**
- ◆ **WORK IN RACE CONTRIBUTES SUBSTANTIALLY TO ITS STANDARDISATION, VALIDATION AND DEPLOYMENT**