Universidad de Alcalá

TEACHING GUIDE

Networks Architecture I

Degree in
Telecommunication Technologies Engineering (GITT)
Telecommunication Systems Engineering (GIST)
Telematics Engineering (GIT)
Electronic Communications Engineering (GIEC)

Universidad de Alcalá

Academic Year 2025/2026

2nd Year - 1st Semester (GITT+GIST+GIT+GIEC)

Approved by the EPS School Board on June 16th, 2025

TEACHING GUIDE

Course Name:	**Networks Architecture I**
Code:	**350010 (GITT+GIST+GIT+GIEC)**
Degree in:	**Telecommunication Technologies Engineering (GITT)** **Telecommunication Systems Engineering (GIST)** **Telematics Engineering (GIT)** **Electronic Communications Engineering (GIEC)**
Department and area:	**Automática** **Automatic**
Type:	**Compulsory (GITT+GIST+GIT+GIEC)**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year - 1st Semester (GITT+GIST+GIT+GIEC)**
Teachers:	Enrique de la Hoz de la Hoz
Tutoring schedule:	To be published at the beginning of the term
Language:	English

1. COURSE SUMMARY

The contents of this subject cover the introduction to telematics, the main components of communication networks and the required knowledge to understand their operation, to carry out performance analysis, to face up data network design and to decide about their establishment.

The learning process follows a top-down approach, starting with those applications that are already being used by students, considering the requirements of those applications to work properly in a distributed environment. Then, we will descend through the different layers of the Internet protocol stack until we arrive to the link layer and its relationship with the physical layer (in Network Architecture II). The transport layer is the last layer studied in Network Architectures I. More concretely, the main topics that are studied in this course are: network elements (hosts, service model, access network and core network), physical media and multiplexing, switching paradigms (circuit switching vs. packet switching), network architectures (service model, network topologies and protocols), telematics services and applications and data transport.

In the first part of the course, the basic concepts that are essential to understand the operation of communication networks (such as: network elements, service model, protocol concept, basic features of physical transmission media that set up links and the concept of multiplexing) are presented.

The different network technologies are classified according to their topology (mesh, star, tree), their size (WAN, MAN, LAN), the type of service that they are able to offer, the distance to the final user (access, aggregation, core), the physical media of the link used by the final user (wireless, wired) and its main features (fixed, mobile). The most common access technologies nowadays are presented and the two main switching paradigms (circuit switching vs. packet switching) are discussed. The concepts of standardization and regulation are also introduced, identifying the main agents involved in both processes.

After this first overview, the study continues, focused on packet switching networks, following a top-down approach to classical protocol architectures applied to a widely extended technology like TCP/IP, analyzing in depth:

- Distributed applications, application protocols and telematic services (web and domain name service).
- Reliable and non-reliable data transport. End to end flow and error control. Retransmission techniques. Congestion control.

The practical contents of the course include activities like monitoring devices and network software, with the most widely used technologies, like Internet or TCP/IP protocol stack. The use of traffic and protocols analyzers is also studied, as well as programming assignments related to application and transport layers.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/352/2009:

en_TR2 - Knowledge of basic subjects and technologies that enables to learn new methods and technologies, as well as to provide versatility that allows adaptation to new situations.

en_TR3 - Aptitude to solve problems with initiative, decision making, creativity, and to communicate and to transmit knowledge, skills and workmanship, comprising the ethical and professional responsibility of the activity of the Technical Engineer of Telecommunication.

en_TR5 - Easy to handle specifications, regulations and mandatory standards.

en_TR8 - Capacity of working in a multidisciplinary and multilingual team and of communicating, both in spoken and written language, knowledge, procedures, results and ideas related to telecommunications and electronics.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/352/2009:

en_CT2 - Ability to use telecommunications and computing aplications (ofimatics, data bases, advanced calculus, project management, visualization, etc) in order to support the exploration and development of nets, services and aplications of telecomunications and electronic.

en_CT3 - Ability to use computer tools to search bibliographic resources or information relating to telecommunications and electronics.

en_CT7 - Knowledge and use of the essentials of programming in networks, systems and services of telecommunication.

en_CT12 - Knowledge and use of the concepts of network architecture, protocols, and communication interfaces.

en_CT13 - Capability to discern concepts of access network versus transport network, circuit and packet switching networks, wired and mobile networks, distributed systems and distributed network applications, voice services, data services, audio, video, interactive and multimedia services.

Learning Outcomes

RA1: Identify the hardware and software components of a network architecture.

RA2: Know and understand the operation of data switching techniques used in data networks.

RA3: Know the main entities responsible for standardization on the Internet.

RA4: Know the concept of communications protocol.

RA5: Know the main stratified architecture models used in data networks (OSI reference modeland TCP/IP architecture) and distinguish the functions of each of their layers.

RA6: Calculate performance metrics and delays in data networks.

RA7: Know the structure and operation of a client/server model.

RA8: Analyse and interpret the main protocols of the application layer, using computer tools.

RA9: Analyse and interpret the main protocols of the transport layer of the TCP/IP architecture,with the aid of computer tools.

RA10: Develop a simple application of a telematic service using standard networkcommunication interfaces.

RA11: Investigate new aspects of networks autonomously and collaboratively using search andinformation management.

RA12: Work in a team group in a collaborative way for the resolution of problems related

withnetworks and communicate efficiently her knowing, procedures, results, and ideas about them,both writing and orally.

3. CONTENTS

Units (chapters shall be specified if necessary)	Number of hours
Unit 1. Network architectures: network elements, protocol, delays, network logic, reference models, TCP/IP protocols.	12 hours (3 weeks)
Unit 2. Application protocols: distributed applications, client/server model, HTTP protocol (web), domain name service (DNS) and network programming using sockets.	16 hours (4 weeks)
Unit 3. Transport layer: reliable and nonâ€reliable transport, retransmission techniques, flow control, congestion control, UDP and TCP protocol.	28 hours (7 weeks)

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

LaNumber of on-site hours:	Large group classes: 26 hours (2 hours x 13 weeks) Reduced group classes: 24 hours (2 hours x 12 weeks) Evaluation: 8 hours (2 hours x 4 tests) **Total:** 58 hours on-site hours
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

Theory lectures (large groups)	• Concept presentation and/or review • Oral presentations and other activities
Practical lectures (reduced groups)	• Practical concept presentation and/or review • Problem solving • Practical lab sessions are aimed at reinforcing key concepts and providing experience with tools such as: APIs for distributed application development, office software, protocol analyzers, and network measurement tools. • Oral presentations and other activities
Tutoring and Consultancy (individual and groups, in-room, e-mail, etc.)	• Solving questions • Support to self-learning
Autonomous working	• Reading assignments • Activities: exercises, search for information, self-assessment quizzes

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

Ordinary Call

In the ordinary call the student will be assessed by Continuous Assessment (EC) process.

Extraordinary Call

The extraordinary call will consist of a similar quiz to that arising in the evaluation system by Final Exam.

5.2. EVALUATION

EVALUATION CRITERIA

Evaluation Criteria must address the extent of acquisition of skills by the student. For this purpose, the following ones are defined.

CE1. The student shows knowledge and understanding of the concepts of network architectures

and protocols explained in each of the content blocks.

CE2. The student can understand and solve practical problems of performance analysis and operation of the protocols reviewed in the subject.

CE3. The student is able to properly use software for protocol analysis tools used during the course.

CE4. The student is able to understand the use of a simple programming interface to develop telematics applications.

CE5. The student shows ability to work in teams in a collaborative way during Small Group activities.

CE6. The student can work autonomously, searching, and properly managing information related to the contents of the subject

GRADING TOOLS

Students have two calls to pass the course: ordinary and extraordinary calls.

Ordinary call:

In the ordinary call, students have two paths to pass the course: continuous or final evaluation. Continuous evaluation is the default system, although those students who cannot follow this mechanism can request the EPS to take the final evaluation exam. Next, you can find the grading tools used in these two evaluations:

- Continuous evaluation

1. Partial Quiz Assessments (PEIx): 2 Partial Quiz Assessments (PEI1 and PEI2) consisting of questions about theoretical issues and the execution of one or more exercises. These partial exams assess three different units (Ux):

U1: Introduction to communication networks and calculation of efficiency parameters in the context of communications networks.

U2: Analysis of the operation of application protocols in TCP/IP network architecture.

U3: Analysis of the operation of transport protocols in TCP/IP network architecture.

PEI1 takes place at the end of the first half of the semester, approximately, at an exact date that will be announced at the beginning of the course, and evaluate the first and second unit of the subject.

PEI2 takes place at the end of the quarter, at the official examination date, and evaluates the third unit of the subject.

2. Personal Work Tests (PS): Consisting on the assessment of the learning process of students by means or short test during the whole term.

3. Laboratory Tests (PL): Consisting of making small theoretical/practical tests and monitoring the work done in Small Group sessions. This will be done by the teacher during the whole term.

Students who do not take any of the two partial tests (PEIx) will have a grade of Not Presented (NP) in the ordinary call.

- Final evaluation

This evaluation consists of one single exam (PEF), which will be held on the day assigned by the EPS Direction for the examination of the subject within the examination period, and based in written exposition or test about theoretical issues and the execution of one or more exercises which cover

the whole content of the subject, including:

- Calculation of efficiency parameters in the context of communications networks.
- Analysis of the operation of the application and transport layer protocols of theTCP/IP architecture.

Extraordinary call:

Those students who did not pass the ordinary call can take another exam, similar to the final evaluation exam of the ordinary call (PEF).

GRADING CRITERIA

Ordinary Call, Continuous Evaluation

Students will take PEI1 and PEI2 exams, and the score obtained will be added to the ones of type PS and PL with the weights indicated in the table.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2, TR3, TR5, CT2, CT3, CT12, CT13, TRU1, TRU3, TRU4	RA1-RA5, RA11	CE1, CE2, CE6	PS	15%
TR2, TR3, TR5, TR8, CT2, CT7, CT12, TRU1, TRU3, TRU5	RA6-RA10, RA12	CE1-CE5	PL	15%
TR2, TR3, TR5, CT2, CT3, CT7, CT12, CT13, TRU1, TRU3, TRU4	RA1-RA8, RA10, RA11	CE1-CE3, CE6	PEI1 (Unit 1 and Unit 2 [Theory and practice])	30%
TR2, TR3, TR5, CT2, CT3, CT13, TRU1, TRU3, TRU4	RA5, RA8, RA9, RA11	CE1-CE4, CE6	PEI2 (Unit 3 [Theory and Practice])	40%

Those students that carry out at least to one of the qualification tests (PEI1 or PEI2), will be considered as presented on the Ordinary Call.

Ordinary call, Final Evaluation

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2, TR3, TR5, TR8, CT2, CT3, CT7, CT12, CT13, TRU1, TRU3, TRU4, TRU5	RA1-RA12	CE1-CE4, CE6	PEF (Units 1, 2 y 3 [Theory and Practice])	100%

Extraordinary call

In the Extraordinary Call for students under continuous assessment the relationship between continuous assessment criteria, evaluation instruments and criteria is as follows. Students will take the PEF exam and, if they have followed the continuous evaluation assessments, the scores of the PS and PL tests will be maintained with the weights indicated in the previous tables. Thus, the weight of PEF will be 70%.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2, TR3, TR5, CT2, CT3, CT12, CT13, TRU1, TRU3, TRU4	RA1-RA5, RA11	CE1, CE2, CE6	PS	15%
TR2, TR3, TR5, TR8, CT2, CT7, CT12, TRU1, TRU3, TRU5	RA6-RA10, RA12	CE1-CE5	PL	15%
TR2, TR3, TR5, TR8, CT2, CT3, CT7, CT12, CT13, TRU1, TRU3, TRU4	RA1-RA4, RA6	CE1-CE4, CE6	PEF (Units 1, 2 y 3 [Theory and Practice])	70%

PEF exam for those students who did not follow the continuous assessment will include questions about PL and PEI evaluations and they will have a total weight of 100%.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2, TR3, TR5, TR8, CT2, CT3, CT7, CT12, CT13, TRU1, TRU3, TRU4, TRU5	RA1-RA12	CE1-CE4, CE6	PEF (Units 1, 2 y 3 [Theory and Practice])	100%

The teaching-learning methodology and the assessment process will be adapted as needed, in accordance with the guidelines of the Diversity Support Unit, to implement curricular adaptations for students with specific needs.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- "Computer Networking: A Top-Down Approach" (7th Edition), J. Kurose & K.W. Ross. Pearson Education, 2017.

6.2. Additional Bibliography

- Data and Computer Communications (9th Edition), W. Stallings. Prentice Hall, 2010.
- Computer Networks (5th Edition), A.S. Tanenbaum. Prentice-Hall, 2010.
- Computer Networking and the Internet (5th Edition), F. Halsall, Addison Wesley, 2005.

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.