
Glossary

A

- ABS** Anti-lock braking system is a vehicle safety system that allows the vehicle wheels to maintain tractive contact with the road surface according to driver inputs while braking, preventing the wheels from locking up and avoiding uncontrolled skidding
- AC** Alternating current is an electric current which periodically reverses direction, in contrast to direct current (DC) which flows only in one direction
- ACC** Adaptive cruise control is an optional control system for vehicles that automatically adjusts the vehicle speed to maintain a safe distance from vehicles ahead
- ACEA** European Automobile Manufacturers Association represents Europe's car, van, truck, and bus manufacturers
- ACM** Association for Computing Machinery is the world's largest educational and scientific computing society and delivers resources that advance computing as a science and a profession
- ACPS** Automotive cyber-physical systems are sophisticated systems which embed electronic components and control systems to improve performance and safety
- ACS** Airbag control system detects and evaluates a crash before triggering the appropriate restraint systems according to the type of collision and its severity
- ACSS** Automotive cloud service system based on SOA for the next-generation automotive software platform
- AD** Autonomous driving or self-driving refers to the capability of a vehicle to sense its environment and to navigate without human input
- ADC** Analog-to-digital converter translates analog electrical signals into digital signals for data processing purposes
- ADAS** Advanced driver assistance systems are systems to help the driver in the driving process by increasing car safety, road safety, and better driving
- ADTF** Automotive Data and Time-Triggered Framework is a framework, which supports automotive software development. It has the advantage of a stable measurement framework, which is used in ADAS and can adopt typical bus data, for example, CAN, FlexRAY, Ethernet, and others, as well as raw data from any sources

- AEB** Autonomous emergency braking is a system that acts independently of the driver and will intervene only in a critical situation to avoid or mitigate an accident by applying the brakes
- AEMP** Association of Equipment Management Professionals is the premier organization serving those who manage and maintain heavy, off-road fleets
- AES** Advanced Encryption Standard is a specification for the encryption of electronic data established by the US NIST
- AG** Stock corporation is a legal form for companies
- AGORA** Framework for the development of intelligent transportation system applications
- AHA** Adaptive high beam assist makes driving in the dark safer and helps to reduce the strain on the driver
- AI** Artificial intelligence is the simulation of human intelligence processed by machines, especially computer systems
- AIC** Availability, integrity, and confidentiality, also known as CIA triad, is a model designed to guide policies for information security within an organization
- AID** Anomaly intrusion detection is a method for detecting both network and computer system intrusions and misuse by monitoring system activity and classifying it as either normal or anomalous
- ANN** Artificial neural networks is a computational model based on the structure and functions of biological neural networks
- ANSI** American National Standards Institute is a private nonprofit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the USA
- AP** Automatic parking is an autonomous vehicle-maneuvering system that moves a vehicle from a traffic lane into a parking spot to perform parallel, perpendicular, or angle parking
- API** Application programming interface is a set of routine, protocols, and tools for building software applications
- APRANET** Advanced Research Projects Agency Network was an early packet-switching network and the first network to implement the protocol suite TCP/IP
- AR** Augmented reality is a method that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view
- ARP** Address Resolution Protocol maps an Internet Protocol address to a physical machine address that is recognized in the local network
- ASD** Agile software development is a set of methods and practices where solutions evolve through collaboration between self-organizing, cross-functional teams
- ASAM** Association for Standardization of Automation and Manufacturing is an incorporated association under German law which members are primarily international automakers, suppliers, and engineering service providers from the automotive industry
- ASIL** Automotive Safety Integrity Level is a risk classification scheme defined by the ISO 26262—Functional Safety for Road Vehicles Standard

ATM Air traffic management is the process by which aircrafts are safely separated in the sky as they fly and at the airports where they land and take off again

AUP Agile Unified Process is a simplified version of the RUP

AUTOSAR AUTomotive Open System ARchitecture is a worldwide development partnership of automotive-interested partners which pursues the objective of creating and establishing an open and standardized software architecture for automotive ECUs excluding infotainment

AV Autonomous vehicle

AVOIDIT Attack Vector, Operational Impact, Defense, Information Impact, and Target efficiently classifies blended attacks by using five major classifiers to characterize the nature of an attack: classification by attack vector, classification by operational impact, classification by defense, classification by informational impact, and classification by attack target

AVP Automatic vehicle parking detects and evaluates a space for parking vehicles in a car park area

B

BAC Blood alcohol concentration refers to the alcohol intoxication of a person usually expressed as a percentage of ethanol in the blood in units of mass of alcohol per volume of blood

BCM Body control module is a generic term for an ECU responsible for monitoring and controlling various electronic accessories in a vehicle's body

BCU Brake control unit is responsible for system control, wheel slide protection, and diagnostics

BDA Big Data Analytics represents a new era in data exploration and utilization

BE Best effort denotes a quality of service in speech and data networks

BEV Battery electric vehicles use electricity stored in a battery pack to power an electric motor and turn the wheels

BFA Brute force attack is a form of attack in which hackers try to crack passwords or decrypt data using raw force (brute force), which means more or less indiscriminate testing

BMVI Ministry for Transport and Digital Infrastructure is a federal government agency of Germany with headquarters in Berlin and Bonn

BNR Business needs and requirements describe the business solution w.r.t. the capabilities required to meet the business needs which describe the business goals, objectives, and problems that the business is trying to solve

BPaaS Business Process as a Service is a form of business process outsourcing (BPO) that employs a cloud computing service model

BSD Blind Spot Detection is a technique that provides 360 degrees of electronic coverage around a vehicle

B2B Business-to-business refers to business that is conducted between companies, rather than between a company and individual clients

B2B2C Business-to-business-to-customer is a model where online, or e-commerce, businesses and portals reach new markets and customers by partnering with consumer-oriented product and service businesses

- BMW** Bavarian motor manufacturer is the parent company of the BMW Group, a globally operating German automobile and motorcycle manufacturer based in Munich, the capital of the state of Bavaria
- BOM** Bill of material is a list of raw materials, subassemblies, intermediate assemblies, subcomponents, parts, and the quantities of each needed to manufacture an end product
- BVDW** Bundesverband für die Digitale Wirtschaft (Federal Association of the Digital Economy) is the central interest representation for companies that operate digital business models and are active in the area of digital value creation
- BYD** BYD Auto Company is a car manufacturer in Shenzhen, Guangdong Province, in the People's Republic of China and a subsidiary of BYD Company Ltd. The company is one of China's largest automobile manufacturers

C

- CaaP** Car-as-a-platform is a model for third party development and applications related to in-car connected platforms, offering a selection of features in connected vehicles with a special focus on entertainment apps and safety-management features
- CAD** Computer-aided design is the use of computer systems supporting analysis, creation, modification, or optimization of a design to increase the productivity of the designer, and improving the design quality and the communications required for documentation, and to create a database for the manufacturing process
- CAE** Computer-aided engineering is the process of solving engineering problems through the use of sophisticated, interactive graphical software in a factory-based environment
- CAESS** Center for Automotive Embedded Systems Security is collaboration between researchers at the UC San Diego and the University of Washington with the research mission ensuring security, privacy, and safety of future automotive embedded systems
- CAM** Computer-aided manufacturing is an application technique using computer software and machinery to facilitate and automate manufacturing processes
- CAN** Controller area network is a serial bus network that connects devices, sensors, and actuators in a system or subsystem for real-time control application
- Car2Go** Car2Go is a carsharing provider of the German automaker Daimler
- CAS** Collision Avoidance (precrash) System is an automobile safety system designed to avoid accidents or at least reduce the severity of an accident
- CASE** Stands for the strategic future areas of networking (connected), autonomous driving (autonomous), flexible use (shared), and electric drives (electric), which Mercedes-Benz Cars consistently drives forward and intelligently connects
- CATIA** Computer-Aided Three-Dimensional Interactive Application is a multi-platform software suite for CAD, CAM, CAE, PLM, and 3D
- CBS** Cloud-based server is a logical server that is built, hosted, and delivered through a cloud computing platform over the Internet

- CC** Cloud computing is a computing-infrastructure and software model for enabling ubiquitous access to shared pools of configurable resources such as applications and services, computer networks, servers, and storage devices
- CCaaSDP** Connected-car-as-a-digital-platform is a model of automakers offering a selection of features in their connected vehicles, with a special focus on entertainment apps and safety-management features
- CCD** Charge coupled device is an integrated circuit etched into a silicon surface forming light-sensitive elements, called pixels
- CCG** Connected car gateway connects the vehicle to the outside world, using multiple wireless technologies
- CCRP** Connected Car Reference Platform is a powerful connectivity platform designed to support a wide range of innovative applications and experiences
- CCS** Combined Charging System is a quick charging method for battery electric vehicles delivering high-voltage direct current via a special electrical connector
- CCU** Central control unit is a powerful microprocessor-based control device
- CDO** Chief Digital Officer
- CE** Concurrent engineering is a work methodology emphasizing the parallelization of tasks which is sometimes synonymously called simultaneous engineering (SE) or integrated product development (IPD)
- CEC** Common engineering client is a project for the development, maintenance, and expansion of the engineering client (EC) as a uniform system-wide user interface for the Daimler product development process and the use in downstream processes
- CED** Canny edge detection is a popular edge detection algorithm developed by John F. Canny
- CHAdEMO** Charge De Move is the brand name of a quick charging method for battery electric vehicles delivering up to 62.5 kW of direct current (500V, 125A) via a special connector
- CIA** Confidentiality, integrity, and availability; see AIC
- CORBA** Common Object Request Broker Architecture is an architecture and specification for creating, distributing, and managing distributed program objects in a network.
- CO_x** Carbon oxide whereby x indicates the index number representing the three oxides of carbon: carbon dioxide, carbon monoxide, carbon sub-oxide
- CPE** Common Platform Enumeration is a standardized method of describing and identifying classes of applications, operating systems, and hardware devices present among an enterprise's computing assets
- CPS** Cyber-physical systems are systems where information and software are connected to physical components, with data transfer and exchange, as well as real-time control over an infrastructure such as the Internet
- CPSEF** Cyber-physical systems engineering framework promises higher productivity and shorter time to market (than non-framework-based approaches) through design and code reuse
- CRC** Cyclic redundancy check is an error-detecting code commonly used in digital networks and storage devices to detect accidental changes to raw data

- CRM** Customer relationship management describes a strategy for the systematic design of all relationships and interactions of a company with existing and potential customers
- CS** Crosswind stabilization belongs to ADAS compensating strong crosswinds
- CS&C** Office of Cyber Security and Communications is responsible for enhancing the security, resilience, and reliability of cyber and communications infrastructure in the USA
- CSMA/CA** Carrier Sense Multiple Accesses with Collision Avoidance is a protocol for carrier transmission in 802.11 networks preventing collisions before they happen
- C2C** Car-to-car is used in the English language literature as vehicle-to-vehicle (V2V) communication. V2V communication is only a sub-point of V2X communication
- C2I** Car-to-infrastructure is a communication model that allows vehicles to share information with the components that support a country's highway system
- CVE** Common Vulnerabilities and Exposures Database is a dictionary of common names for publicly known cybersecurity vulnerabilities
- CVW** Closing vehicle warning is defined as a function that detects closing vehicles in one or more of the rear zones and warns the vehicle driver
- CWS** Collision warning system discriminates between objects which pose a threat of collision from those which do not by measuring the relative sight line rate of the object

D

- DAC** Digital-to-analog converters translate digital signals into analog electrical signals for signal processing purposes
- DAPRA** Defense Advanced Research Projects Agency is an agency of the US DoD which carries out research projects for the US forces
- DAS** Driver assistance systems monitor the vehicle surroundings and the driving behavior to detect potentially dangerous situations at an early stage
- DAT** German Automotive Trust is the information center for the automotive industry
- DAX** German Stock Exchange Index is a measure which indicates the average price of the thirty most important German shares
- D-Bus** Diagnostic Bus is a specialized internal communication network that interconnects components inside a vehicle. Protocols include CAN, LIN, and others
- DBN** Deep belief network is a graphical model which learns to extract a deep hierarchical representation of the training data
- DC** Direct current is the unidirectional flow of electric charge
- DADSS** Driver Alcohol Detection System for Safety automatically detects when a driver is intoxicated with a BAC at or above 0.08 and prevents the car from moving
- DCU** Door Control Unit is a generic term for an embedded system that controls a number of electrical systems associated with a vehicle

- DDD** Driver drowsiness detection is a safety technique which helps prevent accidents caused by the driver getting drowsy
- DDoS** Distributed denial-of-service attack is an attack in which multiple compromised computer systems attack a target, such as a server, website, or other network resource, and cause a DoS for users of the targeted resource
- DDS** Data Distribution Service is an OMG machine-to-machine standard that aims to enable scalable, real-time, dependable, high-performance, and interoperable data exchanges using a publish-subscribe pattern
- DHS** U.S. Department of Homeland Security has a vital mission to secure the nation from the many threats she faces
- DL** Deep learning is part of machine learning methods based on learning data representations as opposed to task-specific algorithms, whereby learning can be supervised, partially supervised, or unsupervised
- DMU** Digital mock-up is a computer-generated trial model used to replace expensive real product/system testing by computer simulation
- DNN** Deep neural networks are distinguished from the more commonplace single-hidden-layer neural networks by their depth in the number of node layers through which data passes in a multistep process of pattern recognition which uses each layer of node trains on a distinct set of features based on the previous layer's output.
- DNS** Domain name system means that Internet domain names are located and translated into Internet Protocol (IP) addresses
- DoS** Denial of service attacks typically flood servers, systems, or networks with traffic in order to overwhelm the attacked resources and make it difficult or impossible for legitimate users to use them
- DP** Digital prototyping allows conceptual design, engineering, manufacturing, sales, and marketing departments the ability to virtually explore a complete product before it is built
- DPA** Differential power analysis is a cryptoanalysis with which the encryption, e.g., of smartcards or other encryption components can be determined and the secret key can be derived
- DSDM** Dynamic systems development method is one of the leading agile approaches, bringing together the agility and flexibility necessary for successful organizations within a framework of the appropriate level of project governance
- DSRC** Dedicated short range communication

E

- EA** Emergency assist monitors the activity of the driver, such as accelerator pedal, brake, and steering, and helps to avoid accidents within the system limits and to reduce possible accident sequences
- EBA** Emergency brake assistant is a vehicle braking technique that increases braking pressure in an emergency case
- EBCM** Electronic brake control module is a control system used to operate brakes simultaneously, provided that the functions and the operating mode of the brake systems are identical

- EBD** Electronic brake force distribution is a vehicle braking technique that automatically varies the amount of force applied to each of a vehicle's wheels, based on road conditions, speed, and loading
- EBOM** Engineering bills of material is a type of BOM reflecting the product as designed by engineering, referred to as the as-designed bill of materials
- e-Call** Emergency call is an automatic emergency call system for vehicles planned by the EU to be compulsorily incorporated into all new models of passenger cars and light commercial vehicles from March 31, 2018
- ECM** Engine control module controls a series of actuators on a vehicle's combustion engine to ensure an optimal engine performance
- ECU** Electronic control unit is any embedded system that controls an electrical system or subsystem in a vehicle
- E/E** Electrical and electronic systems refer to different components of the on-board network. Electrical components are capacitors, inductors, relays, resistors, switches, and others. Electronic components are application-specific integrated circuits (ASICs), integrated circuits (ICs), field programmable gate arrays (FPGAs), microcontrollers (μC), microprocessors (μP), and others
- E/E/PE** Electrical, electronic, and programmable electronic refers to complex systems using computer-based technology
- EEPROM** Electrically erasable programmable read-only memory is a PROM that can be erased and reprogrammed using an electrical charge
- EGNOS** European Geostationary Navigation Overlay Service is a satellite-based augmentation system (SBAS) developed by ESA and EUROCONTROL on behalf of the EU, supplementing GPS, GLONASS, and Galileo satellite navigation system
- EGR** Exhaust gas recirculation is an effective strategy to control NO_x emissions from diesel engines reducing NO_x through lowering the oxygen concentration in the combustion chamber, as well as through heat absorption
- ELP** Electronic license plate is an identification sign mounted on vehicles that emits wireless signals used for tracking and digital monitoring services
- EMC** Electromagnetic compatibility is the interaction of electrical and electronic equipment with its electromagnetic environment and with other equipment
- EMD** Electromagnetic discharge refers to removing a static field/load from equipment
- EMI** Electromagnetic interference is the disruption of operation of an electric device when it is in vicinity of an electromagnetic field in the RF spectrum caused by another electronic device
- EMNS** Entry media and navigation system is a common infotainment and navigation system
- E911** Emergency call is a system used in North America that links emergency callers with the appropriate public resources
- EOC** End of conversion is the time required to convert an analog or a digital signal into a digital or an analog signal

- EPROM** Erasable programmable read-only memory is a type of memory chip that retains its data when its power supply is switched off
- EPS** Electronic power steering assists the driver of a vehicle, unlike traditional systems that act on hydraulic pressure provided via a pump driven by the vehicle's engine, whereby this pump is constantly running, whether the steering wheel is being turned or not
- ERP** Enterprise resource planning is the integrated management of core business processes, often in realtime
- ESA** European Space Agency is an intergovernmental organization dedicated to the exploration of space
- ESC** Electronic stability control is a computerized technology that improves vehicle's stability by detecting and reducing loss of traction. ESC is also referred to as ESP
- ESP** Electronic stability program is one of the most important safety systems on vehicles which improve lateral dynamics, thus ensuring stable driving in all directions
- EssUP** Essential unified process focuses on the essentials to provide eight light-weight, easy-to-use practices that can be mixed and matched and used in different circumstances, all of them compatible with agile values and thinking
- ETA** Estimated time of arrival is the time when a vehicle or emergency service is expected to arrive at a certain place
- EU** The European Union is a political and economic union of 28 member states located primarily in the continent of Europe, holding approx. 40 percent of the area of continental Europe
- EVWS** Electric vehicle warning sounds for hybrids and electric vehicles are a series of sounds designed to alert pedestrians to the presence of electric drive vehicles as well as hybrid electric vehicles
- EWSV** Emergency Warning System for Vehicles is a telematics concept developed particularly for international harmonization and standardization of V2V, R2V, and V2R real-time dedicated short-range communication

F

- FAA** Federal Aviation Administration's mission is to provide the safest, most efficient aerospace system in the world
- FCA** Fiat Chrysler Automobiles is an Italian-controlled multinational corporation incorporated in the Netherlands
- FDD** Feature-driven development is a client-centric, architecture-centric, and pragmatic software process
- FDIS** Final Draft International Standard refers to ISO 9001:2015
- FEM** Finite element method is a numerical method for solving problems of engineering and mathematical physics
- 3G** Third-generation wireless mobile radio standard. 3G is understood as Universal Mobile Telecommunications System (UMTS), High-Speed Downlink Packet

Access (HSPA), as well as HSPA +. Surfing speeds achieved with HSPA+ is up to 28 Mbit/s; surfing speed available with HSPA is up to 5.5 Mbit/s

4G Fourth-generation wireless mobile radio standard. 4G enables significantly higher surfing speeds than the 3G standard allowing theoretically downloads up to 300 Mbit/s

5G Fifth-generation wireless mobile radio standard is the proposed next telecommunication standard beyond the current 4G/IMT advanced standards

FIU Fault insertion units are designed to insert fault conditions between automated test equipment and devices under test

FM Frequency modulation is widely used for a variety of radio communications applications, and it is especially useful for mobile radio communications, being used in taxis and many other forms of vehicles

FMEA Failure mode and effects analysis is a qualitative and systematic tool, usually created within a spreadsheet, to help practitioners anticipate what might go wrong with a product or process.

FMECA Failure, mode and effects, and critical analysis is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service

FMI Functional mock-up interface is a tool-independent standard to support both model exchange and co-simulation of dynamic models using a combination of XML files and compiled C-code

FPGA Field programmable gate array is an integrated circuit that can be programmed in the field after manufacturing

G

GA Genetic algorithms are methods for solving both constrained and unconstrained optimization problems which are based on natural selection

GCN Global communication networks are filtering trading information provided via online GCN, providing information about financial investments, and trading execution via online GCN

GDI Gross domestic income is the sum of all income earned while producing goods and services within a nation's borders

GENIVI GENIVI[®] is a nonprofit industry alliance committed to driving the broad adoption of open source, IVI software and providing open technology for the connected car

GHz Gigahertz is a measure of frequency equivalent to 10^9 cycles per second

GIS Geographical information system is an information system for the collection, processing, organization, analysis, and presentation of spatial data

GLONASS Global Navigation Satellite System using GPS, GLONASS, Galileo, or the Chinese satellite system BeiDou in many applications such as local awareness

GM General Motors is an American multinational corporation that designs, manufactures, markets, and distributes vehicles and parts and sells financial services

- GMRF** Gaussian Markov Random Field models are most widely used in spatial statistics
- GND** Ground is the reference point for all signals or a common path in an electrical circuit where all of the voltages can be measured from
- GNSS** Global Navigation Satellite System is a system that uses provided autonomous geo-spatial positioning
- GNU GPL** GNU General Public License is a widely used free software license which guarantees end users the freedom to run, study, share, and modify the software
- GPRS** General Packet Radio Service is a packet-based wireless communication service that promises data rates from 56 up to 114 Kbps and continuous connection to the Internet for mobile phone and computer users
- GPS** Global Positioning System is a US space-based radio navigation system operated by the US Air Force that helps pinpoint a 3D position to about a meter of accuracy w.r.t. latitude, longitude, and altitude
- GPU** Graphic processing unit is a specialized and optimized processor for computers, game consoles, and smartphones
- GSA** Greenbone Security Assistant is a web application that connects to the OpenVAS Manager and OpenVAS Administrator to provide for a full-featured user interface for vulnerability management
- GSM** Global system for mobile communication is a standard for fully digital mobile networks, which is mainly used for telephony but also for circuit-switches and packet-switches, data transmission, as well as short messages
- GUI** Graphical user interface software that works at the point of contact between a computer and its user

H

- HCD** Head-coupled displays share common elements with immersive VR systems with the goal presenting a realistic, stable computer-generated scene
- HD** High density is a technology which has a considerably higher power density than the standard technology
- HDC** Hill descent control is a vehicle safety feature to facilitate safe travel down steep grades
- HDTRI** High-definition traffic real-time information is used to broadcast real-time information to vehicles
- HFCPI** Hands-Free Cell Phone Interfaces connect headset hands-free and voice dialing hands-free cell phone devices for telecommunication in vehicles
- HIL** Hardware-in-the-loop is a technique that is used in the development and test of complex real-time embedded systems
- HMD** Head-mounted display is a device worn on the head or as part of a helmet that has a small display optic in front of one or each eye
- HMI** Human machine interface is the user interface that connects an operator to the controller for an industrial system

- HP** Hewlett-Packard is an American multinational information technology company headquartered in Palo Alto, California
- HRTS** Hard Real-Time Systems is hardware or software that must operate within the constraints of a stringent time limit
- HTML5** Hypertext Markup Language is a markup language used for structuring and presenting content on the World Wide Web
- HTTPS** Hypertext Transfer Protocol Secure is a communication protocol on the World Wide Web for transferring data securely
- HVAC** Heating, ventilation, and air control is the technology of indoor and vehicular environmental comfort
- HW** Hardware is the key term referring to the mechanical and electronic equipment of a data processing system

I

- IA** Intersection assistance is an ADAS that monitors cross-traffic in an intersection/road junction. If the IA detects a hazardous cross-traffic situation, it prompts the driver to start emergency braking by activating visual and acoustic warnings and automatically engaging brakes
- IAA** International motor show located in Frankfurt/Main (passenger cars) or Hannover (commercial vehicles) shows the latest trends in cars and mobility
- IaaS** Infrastructure as a Service is a form of cloud computing that provides virtualized computing resources over the Internet
- IAM** Identity and Access Management is becoming more and more important through the decentralization of systems, the increased use of mobile devices, and the global access to cloud infrastructures to know which user needs which rights for systems and applications and how they use these rights on which device avoiding getting a problem sooner or later with unauthorized access or data usage
- IB** Interface builder is software within the Xcode IDE that makes it simple to design a full user interface without writing any code
- IBM** International Business Machines is an American multinational technology company
- ICC** International color consortium provides color management systems with the information necessary to convert color data between native device color spaces and device independent color spaces, called the Profile Connection Space (PCS)
- ICE** Internal combustion engine powertrains are dominating the vehicle market today due to their reliability and drivability
- ICT** Information and communication technology encompasses the infrastructure and components which enable modern computing
- IDE** Integrated development environment is a software application that provides a programming environment to streamline developing and debugging software
- IDS** Intrusion detection system is a device or software application that monitors a network or systems for malicious activity or violations
- IDPS** Intrusion detection and prevention systems are two different solutions in that one is a passive detection monitoring system and the other is an active prevention system

- IEC** International Electrotechnical Commission is the world's leading organization that prepares and publishes international standards for all electrical, electronic, and related technologies
- IEEE** Institute of Electrical and Electronic Engineers is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity
- IHC** Intelligent headlight control uses a video camera to measure the ambient brightness and to estimate the distance from vehicles in front and oncoming traffic
- IoDaS** Internet of Data and Services interconnecting data, services, and people through the Internet and improving data analysis, boosts productivity, enhances reliability, and generates new revenue opportunities through innovative business models
- IoE** Internet of Everything can be defined as the intelligent connection of people, processes, data, services, and things
- iOS** Operating system of the company Apple for mobile devices developed for the iPhone, iPad, iPad mini, and iPod touch
- IoT** Internet of Things means networking of objects/things with the Internet, so that these objects/things can communicate independently over the Internet doing different tasks for the owner
- IP** Internet Protocol
- IPSA** Intrusion prevention system architecture determines what assets to protect, the sensitivity of those assets, and the confidentiality, integrity, and availability requirements of the identified assets
- IPT** Image Processing Toolbox™ provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization, and algorithm development
- IPv4** Internet Protocol, version 4 is the 4th revision of the Internet Protocol and a widely used protocol in data communication over different kinds of networks
- IPv6** Internet Protocol, version 6, is a set of specifications from the Internet Engineering Task Force (IETF) that's essentially an upgrade of IPv4
- IS** Intersection support provides a way to asynchronously observe changes in the intersection of a target element with an ancestor element
- ISO** International Standard Organization is an international standard-setting body composed of representatives from various national standards organizations
- IT** Information technology refers to anything related to computing technology, such as hardware, networking, software, the Internet, or people that work with these technologies
- ITIS** Intelligent transportation information systems use advanced communication, information, and electronics technology to solve transportation problems such as traffic congestion, safety, transport efficiency, and environmental conservation
- ITU** International Telecommunication Union is an agency of the United Nations (UN) whose purpose is to coordinate telecommunication operations and services throughout the world

IV Initialization vector is a fixed-size input to a cryptographic primitive that is typically required to be random or pseudorandom

IVI In-vehicle infotainment is a collection of hardware and software in vehicles that provides audio or video entertainment

K

km Kilometer is an abbreviation of distance

KPIT An IT service and consulting company based in Pune, India which offers solutions for medium and large companies in the fields of automotive electronics, industrial automation and chip design, business IT, as well as IT services for banks and insurance companies

kWh kWh is an abbreviation of kilowatt-hour and is the amount of energy that is converted at an output of one kilowatt (1kW) within 1 hour

L

LAN Local area network encompasses computers and peripherals connected to a server within a distinct geographic area such as an office or a commercial establishment

LAS Lateral acceleration sensors used to measure the lateral acceleration acting on the vehicle and calculate the vehicle's actual position

LCA Lane Change Assistant uses two mid-range radar sensors that are concealed in the rear bumper, one on the left and one on the right, which monitor the area alongside and behind the car, whereby control software collates the sensor information to create a complete picture of all traffic in the area behind the vehicle

LDW Lane departure warning alerts the driver if his vehicle is drifting out of the lane using visual, vibration, or sound warnings

LED Light emitting diode is a two-lead semiconductor light source, emitting light when activated

LHW Local hazard warning is some kind of cooperative awareness messages only in that they are transmitted by roadside

LiDAR Light detection and ranging is a remote sensing method that uses light in the form of a pulsed laser to measure ranges, variable distances

LIN Local interconnect network is a serial network protocol used for communication between components in vehicles

LKA Lane keeping assistant combines the functions of BSW and CVW

LKS Lane keeping system uses a camera that can identify lane divisions and works proactively to keep the vehicle within a detected lane

LLVM Low-Level Virtual Machine is a collection of libraries and tools that make it easy to build compilers, optimizers, Just-In-Time code generators, and many other compiler-related programs

LOC Lines-of-code referring to non-commentary lines, meaning pure white space and lines containing only comments, are not included in the metric

LOD Level of detail increases the efficiency of rendering by decreasing the workload on graphics pipeline stages

LSE Large-scale engineering is the process of integrating several components or system into an engineered device

LTE Long-Term Evolution is a 4G wireless broadband technology developed by the 3G Partnership Project (3GPP) of an industry trade group

M

MaaS Mobility-as-a-Service provides an alternative way to move more people and goods in a way that is faster, cleaner, and less expensive than current options

MAC Message authentication code is a cryptographic checksum on data that uses a session key to detect both accidental and intentional modifications of the data

MAN Maschinenfabrik Augsburg-Nuremberg is a vehicle and mechanical engineering group called MAN SE (Maschinenfabrik Augsburg-Nuremberg Societas Europaea)

MANET Mobile ad hoc network is a network that can change locations and configure itself on the fly

MITM Man-in-the-middle attack is a general term for when a perpetrator positions himself in a conversation between a user and an application—either to eavesdrop or to impersonate one of the parties, making it appear as if a normal exchange of information is underway

MBOM Manufacturing bill of material, also referred to as the manufacturing BOM, contains all the parts and assemblies required to build a complete and shippable product

Mbps Megabit per second is used to measure data transfer speeds of high-bandwidth connections, such as Ethernet and cable modems

MEMS Microelectromechanical systems is a technology that can be defined as miniaturized mechanical and electromechanical elements like devices and structures that are made using the techniques of microfabrication

MIL Model in the loop is a technique used to abstract the behavior of a system or sub-system in a way that this model can be used to test, simulate and verify that model

MID Misuse Intrusion Detection actively works to detect potential intrusion threats to vulnerable data

MISRA Motor Industry Software Reliability Association is a programming standard from the automotive industry

MITRE A not-for-profit company that operates multiple federally funded research and development centers created by the split from the Massachusetts Institute of Technology (MIT)

MMS Multimedia Messaging Service offers the possibility to send multimedia messages to other mobile devices or to normal e-mail addresses with a mobile phone

MOM Message-oriented middleware is a specific class of middleware that supports the exchange of general-purpose messages in a distributed application environment

- MOST** Media-oriented systems transport is the de facto standard for multimedia and infotainment networking in the automotive industry
- MPV** Multipurpose vehicle is a type of vehicle favored by families due to a more practical interior than a regular vehicle
- MRF** Markov Random Field is a graphical model of a joint probability distribution
- MRP** Materials requirements planning is a production planning, scheduling, and inventory control system used to manage manufacturing processes
- MTBF** Mean time between failures is the predicted elapsed time between inherent failures of a system, during normal system operation, and is calculated as the arithmetic mean (average) time between failures of a system
- M2M** Machine-to-machine communication is often used for remote monitoring
- MTTF_d** The abbreviation for the mean time to a dangerous failure
- MVC** Model view controller is a software architectural pattern for implementing user interfaces on computers
- MySQL** My Standard Query Language is one of the most used relational database management systems, available as open source software as well as commercial enterprise version for various operating systems, and forms the basis for many dynamic websites

N

- NAFTA** North American Free Trade Agreement is one of the world's largest free trade zones for strong economic growth and rising prosperity for Canada, the USA, and Mexico
- NCS** Network control system is a control system wherein the control loops are closed through a communication network
- NEC** Nippon Electric Company offering digital display solutions
- NECS** Networked embedded computing systems typically consist of multiple computers that are connected by a wireless or wired network
- NFCW** Near field collision warning represents a significant leap in vehicle safety technology by attempting to actively warn vehicle drivers of an impending collision event, thereby allowing the vehicle driver adequate time to take appropriate corrective actions in order to mitigate or completely avoid the event
- NHTSA** National Highway Traffic Safety Administration is responsible for keeping people safe on America's roadways
- NI** National Instruments is an American multinational company with international operation which produces automated test equipment and virtual instrumentation software
- NICB** National Insurance Crime Bureau is a not-for-profit organization that receives support from nearly 1,100 property and casualty insurance companies and self-insured organizations
- NIST** National Institute of Standards and Technology is one of the USA's oldest physical science laboratories
- NoSQL** Non-SQL provides a mechanism for storage and retrieval of data that is modeled in means other than the tabular relations used in relational databases

- NOx** Oxides of nitrogen, abbreviated with NOx, since there are several nitrogen-oxygen compounds due to the many oxidation states of the nitrogen
- NS** Navigation system is a part of the vehicle control used to find a direction in a vehicle which can be achieved by calculating the route
- NSF** National Science Foundation's mission is to advance the progress of science, a mission accomplished by funding proposals for research and education made by scientists and engineers
- NTG** New Telematics Generation is equipped with the advanced, more user-friendly generation of telematics technology
- NURBS** Nonuniform rational B-splines are mathematically defined curves or surfaces which are used in the computer graphics area for modeling shapes or forms
- NVD** National Vulnerability Database is the US government repository of standards based on vulnerability management data represented using the Security Content Automation Protocol (SCAP)
- NVP** Night vision plus can alert the vehicle driver to the potential danger posed by pedestrians or animals in unlit areas in front of the vehicle by automatically switching from the speedometer to a crystal-clear night view image and highlighting the sources of danger, whereby a spotlight function is able to flash any pedestrians detected ahead
- NVT** Network vulnerability tests are a software testing technique performed to evaluate the quantum of risks involved in the system in order to reduce the probability of the event
- NXP** Next eXperience (formerly Philips Semiconductors) is driving innovation in the secure connected vehicle. End-to-end security and privacy and smart connected solutions

O

- OAiT** Open Artificial Intelligence Technologies mission is to build safe artificial general intelligence (AGI) and ensure AGI benefits are as widely and evenly distributed as possible
- OBD** Onboard diagnostics is a computer-based system originally designed to reduce emissions by monitoring the performance of major engine components
- O-D** Origin-destination is a model created to understand travelers' true origins and destinations for any specific trip
- OSW** Obstacle and collision warning alerts vehicle drivers that the vehicle is in immediate danger colliding with an obstacle
- OEM** Original Equipment Manufacturer is a company that produces parts and equipment that may be marketed by another manufacturer
- OMG** Object Management Group is a consortium founded in 1989, which deals with the development of standards for vendor-independent system-wide object-oriented programming
- OOA** Object-oriented analysis in an object-oriented variant of the analysis process and the design process as part of the development of a software system

OPENSIG One-Pair Ethernet Alliance Special Interest Group is an interest group that promotes the introduction of BroadR-Reach, an Ethernet based communication technology in motor vehicles

OpenUP Open Unified Process is a lean unified process that applies iterative and incremental approaches within a structured life cycle embracing a pragmatic, agile philosophy that focuses on the collaborative nature of software development

OpenVAS Open Vulnerability Assessment System is a framework of multiple services and tools that together provide a comprehensive and powerful solution for vulnerability scanning and vulnerability management

OS Operating system is the most important program that runs on a computer

OSI Open systems interconnection is a reference model for how applications can communicate over a network

OSS Operating system scheduler is an essential part of a multiprogramming OS

OTA Over the air refers to various methods of distributing new software, configuration settings, and even updating encryption keys to devices and systems

P

PaaS Platform as a Service is a service that provides a computer platform for developers of web applications in the cloud

PAM Process assessment model holds all details to determine process maturity and relates to one or more PRMs

PAYD Pay as you drive is a type of motor vehicle liability insurance in which the premium is calculated from the quantity and type of vehicle use

PC Personal computer is a multipurpose computer operated directly by the end user, which size, capabilities, and price make it feasible for individual use

PCAST U.S. President's Council of Advisors on Science and Technology is a council, chartered in each administration, with a broad mandate to advise the President on science and technology

PCB Printed circuit board is used to mechanically support and electrically connect electronic components using conductive pathways, tracks, or signal traces etched from copper sheets laminated onto a nonconductive substrate

PCCMS Precrash collision and mitigation system makes use of unique data fusion algorithms that combine the input from radar and vision sensors to enhance safety system functionality by warning vehicle drivers if it estimates a high risk for collision when the equipped vehicle approaches a pedestrian or another vehicle

PCM Powertrain control module is an automotive control component used in vehicles, consisting of the engine control unit and the transmission control unit

PDM Product data management is the holistic company-wide management and control approach of all product data and processes of the entire life cycle from development and production through sales and maintenance

PFD Probability of failure on demand can be done by means of a so-called Markov model

PHYD Pay how you drive is a type of car liability insurance in which the premium is calculated from the quantity and type of vehicle use

- PID** Proportional-integral-differential controller is a control loop feedback device widely used in industrial control systems
- PIN** Personal identification number is a number known only to one or a few persons, with which they can authenticate themselves against a machine
- PL** Performance level is defined according to standard EN 13849 as discrete level that specifies the ability of safety-related parts of a control to perform a safety function under predictable conditions which means it is a measure of the reliability of a security function
- PLC** Product life cycle is the process of managing the entire life cycle of a product from inception, through engineering design and manufacture, to service and disposal of manufactured products
- PLM** Product life cycle management takes into consideration the entire vision of effectively managing and connecting all information related to the process and production data needed to design, produce, validate, support, maintain, and ultimately dispose of manufactured goods
- PMM** Power Management Module is a device feature that allows controlling the amount of electrical power consumed by underlying devices, with minimal impact on performance
- PNT** Positioning, navigation, and timing services is used in combination with map data and other information like weather or traffic data and is the most popular modern navigation system better known as GPS
- POI** Point of interest is a specific point location that someone may find useful or interesting
- PPP** Public private partnership represents the involvement of private economic entities in the execution of public tasks
- PRM** Process reference model describes for a certain application domain a set of processes, whereby each process is described by its purpose and the associated process outcomes. It is always related to a PAM which holds all details to determine the maturity of the processes of the reference model
- PROM** Programmable read-only memory is a read-only memory that can be modified once by a user allowing him to tailor a microcode program using a special machine called PROM programmer
- PS** Parking sensors are embedded to alert the driver to obstacles while parking by measuring distances to nearby objects
- PSAP** Public safety access points are selected in a wireless network for E911 calls
- PSIS** Peripheral sensor interface 5 is an open standard for automotive sensor applications based on existing sensor interfaces, e.g., for peripheral airbag sensors
- PSS** Passive safety system refers to a system that protects vehicle drivers and passengers during a crash, primarily airbags and seatbelts
- PUC** Pollution under control is a valid certification that's granted to a vehicle that has passed the PUC test saying that the vehicular emissions are under control and in accordance with the pollution norms
- PwC** PricewaterhouseCoopers is a multinational professional services network and is one of the big four auditors, along with Deloitte, EY, and KPMG

PWDC Power window and door control are operated by an electric motor and has different types of settings in a vehicle enabling a vehicle driver to open or close any vehicle windows of interest as well as activate the door locks when the ignition key is turned on and the vehicle starts moving. Another setting in PWDC is the automatic window roll-up when the ignition key is turned off and the driver's door is opened or the electric locks are set to lock the vehicle

R

RAM Random access memory is a computer data storage device which stores frequently used program instructions to increase the general speed of a system

R&D Research and development refers to the investigative activities a business conducts to improve existing products and procedures or to lead to the development of new products and procedures

RC4 Rivest Cipher 4 is a stream cipher which is a symmetric key cipher where plaintext digits are combined with pseudorandom cipher digit stream

RDA Rural drive assistance is applied for analysis of rural road drive and alternatives

RDS Radio data system is a protocol for transmitting additional information to a radio transmission

RDP Road departure protection is a special ADAS that can be used to prevent a deviation from the road

RF Radio frequency refers to the rate of oscillation of electromagnetic radio waves in the range of 3 kHz to 300 GHz

RFID Radio frequency identification is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify objects or things

RKE Remote keyless entry is an electronic lock that controls access to a vehicle without using a traditional mechanical key

RKI Remote keyless ignition system refers to an electronic remote control as a key which is activated by pushing a button for a keyless start

RMS Root mean square refers to the mathematical method defining the effective voltage or current of an AC wave

RoI Region of interest is a portion of an image that users want to filter or perform some other operation on

ROI Return on investment is a metric which can be used as a rudimentary gauge of investment's profitability

ROS Robot operating system is a software framework for personal robots; the development began in 2007 at the Stanford Artificial Intelligence Laboratory within the Stanford AI Robot project (STAIR)

RPC Remote procedure call is a protocol that one program can use to request a service from a program located in another computer on a network without having to understand the network's details

RRF Risk reduction factor determines the SIL

- RSA** Rivest-Shamir-Adleman is a cryptosystem for public key encryption which is widely used for securing sensitive data, particularly when being sent over an insecure network such as the Internet
- RSR** Road sign recognition is an ADAS technique by which a vehicle is able to recognize the traffic signs on the road
- RSU** Roadside unit is a computing device located on the roadside that provides connectivity support to passing vehicles
- RTE** Runtime environment is the execution environment provided to an application or software by the operating system
- RTV** Roadside-to-vehicle in the connected car context means that there is some kind of data backbone, an internet gateway, which connects the vehicle and roadside sensors
- RUP** Rational unified process is an iterative software development process framework which is not a single concrete prescriptive process but rather an adaptable process framework, intended to be tailored by the development organizations and software project teams who will select the elements of the process that are appropriate for their needs
- RVS** Rear view system increases the field of view for the vehicle driver and detects additional information for fusion with other parking systems

S

- SaaS** Software as a Service is part of cloud computing, whereby the SaaS model is based on the principle that the software and the IT infrastructure are operated by an external IT service provider and are used by the customer as a service
- SAN** Sensor and actuator network is a network of sensor nodes that can measure data in a system and a network of actuators capable of modifying this system based on the processed sensor data
- SAP** Systems Applications and Products in Data Processing is a leading provider of enterprise software
- SC** Seat comfort is a subjective topic because drivers and passengers are all shaped differently and have their own opinion as to which seat is more comfortable. The best seats for sore backs are those that offer adequate lumbar support, leg support, and a high degree of adjustability
- SCA** Side channel attack makes it possible for an attacker without access to the system itself to deduce how the system works and what data it is processing
- SCADA** Supervisory control and data acquisition is a system of software and hardware elements to maintain efficiency, process data for smarter decisions, and communicate system issues to help mitigate downtime
- SCU** Speed control unit is designed to precisely control engine speed with rapid responses to transient load changes
- SD** Service discovery is the automatic detection of devices and services offered by these devices on a computer network
- SDF** Sensor data fusion means combining sensor data derived from disparate sensors such that the resulting information has less uncertainty than would be possible when these sensor data were used individually

- SDK** Software development kit is a toolkit for software engineers that offering an easy access to a special operating system or a programming language
- SDP** The service discovery protocol is a network protocol that helps accomplish service discovery
- SE** Simultaneous engineering is a concurrent new product development through employing cross-functional teams to reduce cycle time
- SEND** Secure neighbor discovery protocol is a security extension of the neighbor discovery protocol (NDP) in IPv6
- SENT** Single-edge nibble transmission is a protocol for a point-to-point scheme for transmitting signal values from a sensor to a controller
- SFF** Safe failure fraction is a measure of the proportion of all possible faults in the safe direction
- S/H** Sample and hold is an analog device that samples the voltage of a continuously varying analog signal and holds its value at a constant level for a specified minimum period of time
- SHD** Sunroof is a fixed or operable opening in an automobile roof which allows light and/or fresh air to enter the driver/passenger compartment
- SIL** Safety integrity level is defined as a relative level of risk reduction provided by a safety function or to specify a target level of risk reduction
- SIM** Subscriber identity module is a smart card inside a GSM cell phone that encrypts voice and data transmissions and stores data about the specific user so that the user can be identified and authorized to the network supplying the phone service
- SIR** Susceptible-infected-recovered model is a classical approach for describing the spread of infectious diseases with immunity formation, which is an extension of the SI model, in mathematical epidemiology, a field of theoretical biology
- SIS** Susceptible-Infected-Susceptible is also known as the contact process model
- 6LoWPAN** Internet Protocol v6 and low-power wireless personal area network is the name of a concluded working group in the Internet area of the Internet engineering task force (IETF)
- SMS** Short message system is a way of sending short written messages from one mobile phone to another
- SMW** Smart mirrors and wipers allow improving the visibility if the mirrors had wipers in case of rainy weather conditions
- SNR** Stakeholder needs and requirements represent the views of those at the business or enterprise operations level as a set of requirements for a solution that can provide the services needed by the stakeholders
- SOA** Service-oriented architecture is a software design style where services are provided to other components by application components and by a communication protocol over a network
- SoC** System-on-a-chip is a microchip with all the necessary electronic circuits and parts for a given system, such as a smartphone or wearable computer, on a single integrated circuit

- SOC** Start of conversion is the time when converting an analog or a digital signal into a digital or an analog signal starts
- SOME/IP** Scalable service-Oriented Middleware over IP is an automotive middleware solution that can be used for control messages which was designed from beginning on to fit devices of different sizes and different operating systems perfectly
- SOS** Save our souls is used mostly by the military, but anyone around the world understands what it means
- SPL** Sound pressure level is a logarithmic quantity for describing the strength of a sound event
- SPT** Security penetration test is an authorized simulated attack on a vehicle's computer system that looks for security weaknesses, potentially gaining access to the system's features and data
- SQL** Structural Query Language is a standard computer language for relational database management and data manipulation
- SRTS** Soft Real-Time Systems devices with weak real-time constraints
- STA** Station or wireless end point is a device that has the capability to use the 802.11 protocol
- STEP** Standard for the exchange of product model data is an ISO standard for the exchange of CAD files with a standardized description of product and process data. STEP data are used in computer-assisted technologies such as CAD, CAE, and CAM, as well as PDM
- S/N** Signal-to-noise ratio is a measure of signal strength relative to background noise, usually measured in decibels (dB) using a signal-to-noise ratio formula
- SUV** Sports Utility Vehicle is a passenger car with driving comfort and increased off-road capability, classified as a light truck, but operated as a family vehicle
- SW** Software
- SWAS** Steering wheel angle sensors recognize how far the steering wheel is turned
- SWOT** Strengths-Weaknesses-Opportunities-Threats is a structure planning method that evaluates those four elements of a system, project, organization, or business venture
- SyRS** System requirement specification is a structured collection of information that embodies the requirements of a system
- SysML** Systems Modeling Language is a general-purpose modeling language for systems engineering applications supporting the specification, analysis, design, and V&V of a broad range of systems

T

- TCM** Transmission control module is a device that controls electronic automatic transmissions to calculate how and when to change gears in the vehicle for optimum performance
- TCO** Total cost of ownership is the purchase price of an asset plus the costs of operation

- TCU** Telematics control unit refers to the embedded system onboard of a vehicle that controls tracking of the vehicle
- TCS** Traction control system is a car safety feature that prevents wheels from spinning on low-grip surfaces
- TCP/IP** Transmission Control Protocol/Internet Protocol is a family of network protocols also known as an Internet Protocol family because of its great importance for the Internet
- TelCO** Telematics' Control Unit refers to the embedded system onboard a vehicle that controls the tracking of the vehicle
- TFS** TaxiForSure is a value-based cab company which cab aggregator Ola has shut down
- 3C** Computation, communication, and control represent three categories in ICT
- 3D** Three-dimensional describes an image that provides the perception of depth
- TKIP** Temporal key integrity protocol is a stopgap security protocol used in the IEEE 802.11 wireless networking standard
- TMC** Traffic message channel is a technology for delivering traffic and travel information to motor vehicle drivers
- TMCU** Transmission control unit is similar to an engine control unit, but it is responsible for the proper operation of a modern transaxle or transmission
- TOF** Time of flight describes a variety of methods that measure the time that it takes for an object, particle or acoustic, electromagnetic, or other waves to travel a distance through a medium
- TPS** Tire pressure sensor is a device to monitor the air pressure inside the pneumatic tires of vehicles and report real-time tire pressure information to the driver of the vehicle
- TPM** Trusted platform module is a standard that defines a hardware root of trust (HrOT) widely accepted as more secure than software that can be more easily breached by attackers
- TPMS** Tire pressure monitoring system is a real-time sensor-based pressure measurement device
- TRIC** Tahoe Reno Industrial Center in Storey County is Tesla's Gigafactory 1 for battery pack production
- TRW** Thompson Ramo Wooldridge is a former US automotive part supplier which was taken over by ZF
- TSR** Traffic sign recognition is an image processing technique by which a vehicle is able to recognize the traffic sign on the roads and is part of ADAS. The detection methods can be generally divided into color-based, shape-based, and learning-based methods
- TSS** Daimler TSSS GmbH is a wholly owned subsidiary of Daimler AG acting as a corporate IT service provider serving exclusively customers in the Daimler Group
- TTM** Time to market is the length of time taken in the product development process from the product idea to the finished product

U

UAV Unmanned autonomous vehicle is a machine that can move through the terrain intelligently and autonomously without the need for any human intervention

UBI Usage-based insurances are also known as pay as you drive (PAYD) and pay how you drive (PHYD) and mile-based vehicle insurance, whereby the cost depends upon the type of vehicle used, measured against time, distance, behavior, and place

UDS Unified diagnostic service is a diagnostic communication protocol in the ECU environment within the automotive electronics, which is specified in the ISO 14229-1

UK The United Kingdom is a sovereign state in Northern Europe based on a constitutional monarchy

UML Unified modeling language is a general-purpose modeling language that is intended to provide a standard way to visualize the design of a system

US/USA The United States of America is a country of central and northwest North America with coastlines on the Atlantic and Pacific Oceans including the non-contiguous states of Alaska and Hawaii and various island territories in the Caribbean Sea and Pacific Ocean

USB Universal serial bus is an industry standard that defines cables, connectors, and communication protocols for connection, communication, and power supply between computers and devices

US-CERT US-Computer Emergency Readiness Team strives for a safer, stronger Internet for all Americans by responding to major incidents, analyzing threats, and exchanging critical cybersecurity information with trusted partners around the world

USD US Dollar is the official currency of the USA and its insular territories per the US Constitution

V

VANET Vehicle ad hoc network is a technology that uses moving cars as nodes in a network to create a mobile network which could be treated as a subgroup of MANET

VAS Vehicle audio system is equipment installed in a vehicle to provide in-car entertainment and information for the vehicle users

V&V Verification and Validation are independent procedures that are used together for checking that a system/product meets requirements and specifications and that it fulfills its intended purpose

VBAT Battery voltage is the supplying electric power

VCM Vehicle control module is a configurable, multipurpose controller device developed to meet the requirements of vehicle applications

VCS Vehicular communication systems are networks in which vehicles and RSUs are the communicating nodes, providing each other with information, such as safety warnings and traffic information

- VDA** German Association of the Automotive Industry is an interest group of the German automotive industry, both automakers and automobile component suppliers
- VDI** German Association of Engineers is one of the largest technical and scientific associations in Europe. Its role in Germany is comparable to that of the American Society of Civil Engineers (ASCE) in the USA
- VE** Virtual environment is a computer-generated 3D representation of a setting in which the user perceives them to be and which interaction takes place
- VEDS** Vehicle emergency data sets provide useful and critical data elements and the schema set needed to facilitate an efficient emergency response to vehicular emergency incidents
- VERDICT** Validation Exposure Randomness Deallocation Improper Conditions Taxonomy shows that all cyber attacks can be classified under four improper conditions, namely, validation, exposure, randomness, and deallocation
- VLC** Media player format is usable for almost all files and formats which is made possible by codes that are already implemented and required for different formats
- VP** Virtual prototyping is a method in the process of product development which involves CAD and CAE software to validate a design before building up a physical prototype
- VR** Virtual reality is the representation and simultaneous perception of reality and its physical properties in a real-time computer-generated, interactive virtual environment
- V2E** Vehicle to environment can position the vehicle in the surrounding environment, but the environment can also sense and position the vehicle with intelligent components
- V2H** Vehicle to home system makes it possible to draw power from electric vehicles (EV's) large capacity batteries through a distribution board to power a home
- V2I** Vehicle-to-infrastructure is a communication model that allows vehicles to share information with the components that support a country's highway system
- V2R** Vehicle-to-roadside is supported by V2I protocol and V2R
- V2V** Vehicle-to-Vehicle is an automotive technology designed to allow vehicles to talk to each other
- V2X** Vehicle-to-X is the wireless exchange of critical safety and operational data between vehicles and road infrastructure
- VW** Volkswagen is the regular brand of Volkswagen AG

W

- WAVE** Wireless access for the vehicle environment is currently considered as the most promising technology for vehicular networks supporting interoperability and robust safety communications in a vehicular environment
- WCCPS** Wireless cyber-physical surveillance systems combine low-end sensors with cameras for large-scale ad hoc surveillance in unplanned environments

- WEP** Wired equivalent privacy is a security protocol, specified in the IEEE Wi-Fi standard, 802.11b, that is designed to provide a WLAN with a level of security and privacy comparable to what is usually expected of a wired LAN
- Wi-Fi** Wireless Fidelity is a type of wireless network technology used for connecting to the Internet
- WPA** Wi-Fi protected access is a security standard for users of computing devices equipped with wireless Internet connections, or Wi-Fi
- WLAN** Wireless local area network is a wireless distribution method which links two or more devices using wireless communication within a limited area which provide a connection to the wider Internet
- WNC** Wireless network connections allow working independently which need a broadband Internet connection and modem and a wireless router
- WSAN** Wireless sensor and actuator network is a group of sensors that gather information about their environment and actuators, such as servos or motors that interact with them, whereby all elements communicate wirelessly; interaction can be autonomous or human controlled
- WSN** Wireless sensor network are spatially distributed autonomous sensors to monitor physical or environmental conditions and to cooperatively pass their data through the network to other locations
- WSS** Wheel speed sensor is a sender device used for reading the speed of a vehicle's wheel rotation
- WVSC** Wireless Vehicle Safety Communication helps to overcome some of the limitations of autonomous systems and enhance the overall safety system performance
- WDDW** Wrong-way driving warning is a new ADAS to prevent wrong-way driving
- WYSIWYG** What you see is what you get editor or program that allows a developer to see what the end result will look like while the interface or document is being created

X

- XaaS** X-as-a-Service refers to an approach to provide and consume everything (X) as a service
- XML** Extensible markup language is a simple, very flexible text format derived from SGML (ISO 8879)
- XOR** Exclusive OR is a logical operation that outputs true only when inputs differ; one is true the other is false
- XP** Extreme programming is a method which places the task of solving a programming task at the forefront of software development and thereby makes a formalized approach less important

Y

YRS Yaw rate sensor is a gyroscopic device that measures a vehicle's angular velocity around its vertical axis, whereby the angle between vehicle's heading and vehicle's actual movement direction is called slip angle which is related to the yaw rate

Z

ZF Gear Factory is a German car parts maker headquartered in Friedrichshafen

Index

A

Access

- direct physical, 330
- misdirection, 330
- progressive, 330
- unauthorized, 88, 267, 270, 297, 314, 325, 338, 496, 582

Accuracy, 67, 102, 104, 158, 218, 254, 255, 257, 518, 544, 550

Activities, 8, 23, 29, 31, 33, 45, 46, 48, 54, 60, 62, 65, 69, 72–76, 97, 132, 173, 174, 176, 178, 185–187, 202, 205, 217, 228, 237, 248, 274, 278, 280, 288, 300, 304, 305, 319, 340, 341, 343, 345, 350, 381, 394, 417, 421, 423, 430, 432, 439, 452, 457, 495, 497, 500, 518, 549, 550, 571, 590

Actros, 30

Actuator

- capabilities, 176
- scheduling, 176

Ada, 184

Adaptive

- cruise control (ACC), 96, 100, 142, 152, 157–159, 162, 253, 257, 302, 332, 514, 516, 550, 569, 586
- high beam assist (AHA), 96

Address spoofing, 351, 371

Ad hoc

- computer network, 223
- mode, 146, 344

Advanced

- driver assistance system (ADAS), 9, 10, 47, 95, 149–151, 166, 498, 513, 514, 516–518, 582

research and technology for embedded intelligence systems (ARTEMIS), 172

research projects agency network (ARPANET), 206

simulation and control engineering tool (ASCET), 131

Advanced driver assistance systems (ADAS), 10, 13, 25, 27, 83, 96, 133, 147, 150–155

Advantage

- competitive, 68, 74, 128, 379, 560
- financial, 62
- time, 62

AEMP telematics standard, 219, 220

Aftermarket

in-vehicle connectivity solutions, 228

Aftersales service, 70, 129

Agent

theory, 277

Agile

- manifesto, 128, 379, 384, 433
- modeling, 129
- software development (ASD), 127–129, 166, 379, 384
- unified process (AUP), 129

Agility, 3, 128, 379

Airbag control system (ACS), 93, 100, 323

Airbiquity, 240, 245

Aircraft, 24, 28, 189, 217, 304, 572

Alcohol blood level, 26

Algorithm, 4, 28, 50, 52, 54, 69, 84, 106, 113, 130, 131, 152, 174, 175, 178, 179, 183, 205, 206, 243, 246, 254, 257, 267, 275–279, 282, 287, 288, 291, 310, 320, 322, 337, 339, 341, 351,

- 352, 354, 355, 385, 413–415, 462, 466, 472, 478, 492, 495, 502, 513, 516, 524, 530, 531, 534, 538–544, 563, 566, 570
- Analog-digital-converter (ADC), 104, 107–109, 145, 165, 173
- Analytic shapes, 52
- Anatomy of automotive hack, 366
- Android
 - auto, 241
 - car, 379, 397
 - software development kit, 379, 395
 - technology stack, 395
- Anomaly
 - detection, 288, 289, 300, 369
 - detection techniques, 289, 300
 - intrusion detection, 279, 282, 291, 340–343, 467, 505
- ANSI/EIA 632 model, 72, 73
- Antilock braking system (ABS), 92, 93, 100, 134, 320, 550
- App
 - development, 379, 387, 390, 398, 432
 - market, 379, 388
 - mobility, 379
 - store, 233, 334, 383, 384, 409
- Apple
 - CarPlay[®], 101, 241, 397
 - iCloud ecosystem, 379, 390
 - iOS, 379, 383, 389, 393–395, 397, 404, 405, 409, 415, 432
 - APIs, 392
 - architecture, 390
 - platform, 390
 - simulator, 394
 - iPhone[®], 101, 233
 - iWatch, 389
 - MAC OS, 337, 379, 389, 391, 393
 - mobile devices, 389
 - project Titan, 34, 570
- Application programming interface (API), 149, 151, 219, 237, 240, 315, 379, 390, 392, 394, 395, 398, 412–415, 565
- Architecture of a battery management system, 450
- Arena, 35
- Arterial roads, 516
- Artificial
 - intelligence (AI), 4, 210, 241, 246, 255, 265, 272, 273, 369, 517, 526, 550, 570, 586, 590
 - neural network (ANN), 273, 274, 500, 506
 - neural network based IDS, 500–503
- Ashok Leyland, 16, 49, 50, 56, 57, 64
- Assembly analysis, 55
- Assistance function, 28, 33, 34, 127, 248, 254, 513, 514, 517, 518, 550, 552, 569
- Association for computing machinery (ACM), 183
- Associative reasoning, 282
- Asymmetric cryptographic algorithms, 355
- Attack
 - anatomy, 265
 - on the billing system, 478
 - graphs, 292, 293
 - scenarios, 265, 268, 269, 331, 349, 367, 454, 463, 506
 - surface, 265, 330–338, 340, 346, 362, 364, 365, 370, 439, 453–456, 503, 514, 566, 570, 582, 587
 - surface intrusion points, 332, 333, 335, 336
 - taxonomy, 326, 370
 - value chains, 307–309, 370
 - value chains in vehicles, 308
 - vector, operational impact, defense, information impact, and target taxonomy (AVOIDIT), 328, 329
 - vulnerability, 566
- Audi, 30, 33, 115, 129, 257, 517, 560, 562
- Augmented reality (AR), 58, 77, 241
- Authentication mechanism, 353, 453, 456, 479
- Authorization, 453
- Auto-code generation, 131, 544
- Automaker, 1–3, 5–7, 9, 19, 26, 30, 45, 46, 48, 88, 89, 94, 96, 115, 126, 132, 142, 145, 147–149, 163, 181, 214, 222, 224–226, 228–230, 232, 233, 237, 238, 240, 245–248, 252, 254, 256, 257, 267, 269, 281, 302, 304, 307, 313–316, 322, 335, 336, 345, 348, 362, 365–368, 490, 589
- Automated
 - driving, 28, 147, 251, 256, 259, 556, 558, 560, 571
 - valet parking, 10, 452, 493–496, 505, 582
- Automatic
 - climate control (ACC), 83, 94, 96, 126
 - cooling (AC), 94
 - headlamps (AH), 94
 - parking (AP), 152, 159, 160, 164, 216, 517, 569, 586
 - test sequences, 133
 - vehicle parking (AVP), 96
 - wipers (AW), 94

Automotive

- aftermarket, 17, 19
 - attack surfaces and vulnerability, 265
 - cloud service system (ACSS), 230, 259
 - cyber-physical systems, 9, 85, 86, 171, 173–197, 199–206, 209, 257, 265, 267, 268, 270, 271, 280–283, 294, 295, 300, 308, 309, 316–324, 326, 328, 332, 337, 345, 346, 348, 354, 360, 362, 582
 - cybersecurity, 7, 9, 265–346, 348–371, 582, 587
 - data and time triggered framework (ADTF), 565
 - development process, 45–62, 77
 - E/E systems, 9, 26, 28, 45, 86, 95, 110, 111, 127, 132
 - electronics, 10, 83, 86–109, 120, 151, 165, 221, 248, 269, 307, 405, 582, 590
 - engineering, 181, 581, 583, 590
 - industry, 1, 3, 7, 9, 13–38, 45, 83, 88, 111, 116, 120, 126, 129, 142, 149, 163, 214, 222, 225, 232, 234, 241, 245, 247, 248, 252, 256, 268, 269, 302, 303, 305, 308, 315, 319, 336, 360, 380, 382, 432, 496, 513, 559, 581, 583, 588–590
 - IT, 302–307, 337, 380, 387
 - manufacturers, 14, 27, 129, 229, 502
 - mechatronic, 9
 - mega trends, 13, 19, 37, 38
 - night vision, 516
 - open source architecture (AUTOSAR), 127, 142–145, 147, 166, 311–314, 514, 566, 582
 - open source architecture adaptive platform, 83, 127, 131, 147
 - protection mechanisms, 26, 359
 - safety, 120, 122, 132, 360, 566
 - safety integrity level (ASIL), 120, 122, 123, 132, 360, 361, 371, 571
 - security, 338
 - software development, 127, 128, 132, 138, 149, 247, 561
 - software engineering, 83, 126, 590
 - Spice[®], 127, 129
 - suppliers, 3, 32
 - transformation, 9
- AUTomotive Open Source Architecture (AUTOSAR)
- adaptive platform, 83, 147
 - application, 145, 146, 148, 311, 314
 - network, 147

- open standardized software architecture for automotive ECU, 311
- operating system, 145, 147

Autonomous

- car, 25, 28, 463, 514, 517, 549, 552, 554, 557, 558, 566, 569, 571, 572, 583, 587–589
 - delivery robot, 37
 - driving (AD), 26–28, 105, 171, 302, 480, 493, 513, 581
 - emergency braking (AEB), 141, 152, 160
 - mobility, 552
 - vehicle, 4–6, 28, 34, 95, 101, 167, 171, 214, 241–247, 254, 255, 259, 505, 513, 552, 557, 560, 570, 589
- Autopilot function, 557
- Availability, integrity, and confidentiality (AIC) triad, 331
- Avert, 266, 439
- AVOIDIT architecture, 328, 329

B

- Backend system, 25, 432, 439, 446, 453, 456
- Background subtraction
 - algorithm, 534, 535
 - model, 536, 537
- Backoffice, 240, 443
- Backpropagation algorithm, 4, 281
- Backscatter modulation, 212
- Bandwidth, 87, 103, 118, 119, 147, 173, 230, 351, 499, 561, 564, 569, 586
- Bangalore, 20, 405, 465, 468
- Basic
 - functions, 53, 64, 143, 227, 311, 421
 - reproduction rate, 284
 - spline function, 51
- Battery
 - capacity, 220, 583
 - management system, 22, 139, 449
 - prices, 22, 38
- Behavior detection, 296
- Bellman-ford algorithm, 175, 257
- Benchmark, 46, 155, 286, 390
- Bernstein polynomial, 50
- Bézier
 - curves, 53
 - net, 51
 - point, 51
 - representation, 50, 51
 - surface, 50, 51, 77
- Bharat-Benz, 16, 30, 57
- Big data analytics (BDA), 1, 4, 239, 463

- Bills of materials (BOMs), 61
- Black
 - hat Asia security conference, 324
 - hole attack, 499
- Blending of technology, 67
- Blind spot
 - detection (BSD), 152, 153, 158–160, 162, 514, 569, 586
 - sensor, 521
- Block algebra equations, 192
- Blood alcohol concentration (BAC), 95
- Bluetooth, 101, 215, 223, 227, 237, 238, 249, 252, 253, 306, 331–333, 365, 366, 395, 397
- BMW
 - connectedDrive store, 171, 249, 260
 - DriveNow, 440, 452, 455
- Body
 - control module (BCM), 89
 - control unit (BCUnit), 320
 - electronics, 86, 89–92, 118, 119, 139, 165
 - network, 88
- Boeing, 55, 70
- Bogus messaging, 499
- Bosch
 - car multimedia, 248
- Bot algorithms, 478
- Boundary control points, 54
- Brake
 - assistant, 514
 - by-wire, 116
 - control unit (BCU), 320
- Brightness patterns, 538, 539
- Broadcasting
 - serial network protocol, 115
- Brushless, asynchrony machine, 449
- Brute force attack (BFA), 339
- B-spline
 - surface, 51, 52
- Bus
 - system, 83, 110–112, 114–121, 126, 165, 166, 230, 310, 313, 322, 330, 501, 503, 552, 561, 569, 582, 586
- Business
 - as-a-service (BaaS), 238
 - case, 3, 47
 - model, 1, 5, 7, 8, 10, 19, 24, 35, 147, 149, 171, 183, 214, 220, 225–228, 231–233, 238, 241, 259, 269, 314, 315, 439, 441, 461, 462, 464, 465, 488, 491, 505, 550, 581, 582, 586, 589
 - needs and requirements (BNR), 59
 - to-business (B2B), 7, 226, 234
 - to-business-to-customer (B2B2C), 7
- BYD, 33
- Byzantine
 - failure, 358
 - model, 358, 371
- C**
- C, 103, 130, 131, 184, 276, 337, 379, 391, 394, 398
- C++, 184, 276, 337, 379, 393, 394, 404, 544
- Cab
 - aggregator, 461, 472, BNF–467
 - services, 409, 461, 463, 465, 466
- Camera
 - based sensor, 2, 154, 156, 159, 160, 210, 243, 260, 489, 495, 497, 517, 525, 526, 552, 556, 561, 564, 566, 569
 - rigs, 34
- Canny edge detection algorithm, 530
- Car
 - as-a-platform (CaaP), 334
 - density, 17, 18, 20
 - E/E system, 9, 26, 28
 - hacking, 28, 237, 266, 362, 371, 587
 - hacking village, 26
 - hailing and ride sharing, 461
 - information technology (IT), 6, 9, 34, 126, 215, 225, 230, 234, 238, 240, 267, 306, 455
 - insurance companies, 19, 28, 231
 - insurance policy, 19
 - in-the cloud, 171, 238–241, 243, 259, 550
 - ownership, 13, 17, 20, 23, 440, 586
 - park operators, 486
 - play, 38, 231, 387, 397, 435, 504, 505, 550, 552, 571, 572
 - pooling, 405
 - rental, 24, 439, 441, 448, 454, 455
 - ride, 24, 404, 461, 486, 503, 571
 - sharing, 24, 28, 220, 379, 404, 405, 440, 441, 452, 454, 462, 477, 485, 496, 505, 571
 - sharing activities, 439, 452
 - sharing model, 220, 379
 - sharing services, 439–441, 452, 473
 - to-backend (C2B), 25, 439, 453
 - to-car (C2C), 25, 201, 550, 566
 - to cloud communication, 570, 587
 - to-go-business model, 439, 441
 - toGo concept, 441, 454
 - to-infrastructure (C2I), 550

- Cartesian product, 51
- CeBit, 35, 247
- Center
 - for automotive embedded systems security (CAESS), 364
 - experimental security analysis of a modern automobile, 364
 - of mass, 542
- Central
 - control points, 50
 - control unit (CCU), 321
 - gateway, 323, 502
- Centroid in a plane, 542
- Change
 - in brand loyalty, 163
 - in customer demand, 163
 - management, 64, 65, 67
 - in mobility, 163
- Characteristic polyhedron, 51
- Charge De Move (ChaDeMo), 22
- Charging
 - infrastructure, 22, 447, 448, 453, 454, 585, 589
 - station, 448, 449, 455
- Chassis
 - electronics, 86, 92, 93, 165
 - system, 92
- Check-out phase, 444, 445
- China, 3, 14, 16, 17, 20, 27, 33, 86, 388, 441, 462, 464, 477, 478, 584, 586
- Choreo platform, 240
- Classification
 - of common cybersecurity risks, 272
- Closed-loop control system
 - block diagram, 191
 - symbols, 191
- Cloud
 - access, 248, 269
 - based detection, 296
 - based infrastructure, 234
 - based security, 357
 - based systems, 239
 - based technologies, 239, 240
 - computing, 1, 178, 179, 238, 266, 357–360, 371
 - networks, 357
 - services, 6, 238, 239, 305, 309, 412
- COBOL
 - code, 382
- Cocoa Touch Layer, 391
- Code portability, 181
- Collaborated
 - and parallel work, 56
 - work, 45, 67
- Collaboration, communication, control (3C), 85, 177
- Collision
 - avoidance (pre-crash) system (CAS), 517
 - free motion, 96
 - warning system (CWS), 517, 521
- Color model, 526–528
- Combination of parking and charging, 496
- Combined charging system (CCS), 22
- Combustion
 - engine, 19, 21, 23, 34, 38, 97, 163, 448, 449, 456, 584
 - engine vehicles, 19, 22, 97
- Comfort electronics (CE), 87, 94, 165
- Commercial
 - of the shelf systems (COTS), 380, 433
 - vehicle, 2, 7, 13, 16, 17, 30, 141, 474, 581, 584
- Common
 - engineering client, 381
 - vulnerabilities and exposures database (CVE), 280
- Communication and entertainment systems, 86
- Competing charging standards, 22
- Complementary software (CSW), 145, 313
- Complex modeling and simulation, 53
- Complexity, 10, 28, 45, 47, 54, 56, 59, 83–85, 88, 110, 111, 113, 116, 126–130, 132, 133, 136, 137, 142, 143, 148, 152, 175, 177, 181–184, 265, 266, 269, 311, 313, 315, 322, 331, 350, 385, 391, 433, 461, 492, 525, 549, 550, 557, 581
- Component
 - analysis, 181, 545
 - supplier, 46
 - test, 133, 140
 - vulnerability, 338
- Compound anomaly detection, 342
- Compromised
 - key attacks, 317, 370
 - privacy, 309, 310, 340
- Computer
 - aided design (CAD), 45, 49–51, 54–57, 64, 65, 67–69, 77, 382, 581
 - aided engineering (CAE), 55, 57, 65, 77, 581
 - aided manufacturing (CAM), 65, 67
 - assisted perception, 58
 - emergency readiness team (CERT)
 - taxonomy, 323, 328
 - format, 1, 45, 101, 130, 145, 146, 219, 256, 313, 320, 334, 345
 - graphics, 50, 51, 54, 57, 131, 147, 326, 526, 527
 - modeling and simulation, 66
 - society, 59, 183

- Computer aided design (CAD), 45, 49–51, 54–57, 64, 65, 67–69, 77, 382, 581
- Computer aided engineering (CAE), 55, 57, 65, 77, 581
- Computer aided manufacturing (CAM), 65, 67
- Computer aided three-dimensional interactive application (CATIA), 49, 50, 64, 382
- Computerized motor management, 35
- Computing
 - performance, 87
 - technology, 266
- Conceptual ideas, 69
- Conceptualization phase, 45, 46, 73, 77
- Concierge services, 251
- Concurrent engineering (CE), 55, 56
- Conic sections, 52
- Connected
 - car, 5, 7–10, 25, 38, 101, 105, 166, 171–257, 267, 269, 334, 335, 379, 485, 490, 498–500, 503, 504, 506, 550, 569, 581, 582, 585
 - platform, 233, 241, 259
 - reference platform, 171, 237, 259
 - services, 7, 227, 233, 435, 490
 - car-as-a-digital-platform (CCaDP), 335
 - drive, 488, 582
 - home, 250
 - parking, 384, 485–507, 582
 - parking app, 488, 504
 - services, 225, 232, 310, 384
 - trucks, 245
 - world, 8, 363
- Connectivity, 2, 4, 5, 7–10, 13, 19, 25, 29, 85, 87, 95, 101, 126, 136, 147, 208, 225–228, 231–233, 235–241, 247, 252, 257, 268, 269, 282, 305, 306, 330, 336, 355, 365, 367, 395, 439, 446, 453, 455, 456, 485, 496, 503, 550, 570, 581–583, 585, 587
- Constraint, 1, 37, 49, 73, 99, 110, 135, 150, 183, 196, 201, 204, 234, 241, 283, 290, 305, 317, 324, 340, 341, 343, 395, 412, 506, 539, 563
- Conti, 31, 493, 551
- Continental, 3, 153, 154, 159, 256, 517
- Control, 6, 13, 45, 83, 171, 265, 380, 449, 473, 492, 514, 581
 - derivative, 193–197, 199, 200, 258
 - integral, 193–197, 258
 - point, 50, 51, 53, 54
 - point matrix, 53
 - proportional, 193–196, 258
 - proportional integral derivative (PID), 196, 197, 199, 200
 - system, 65, 94, 96, 100, 107, 118, 127, 132, 176, 177, 189–197, 199–201, 210, 216, 253, 258, 266, 270, 283, 323, 332, 363, 368, 516, 543
- Controllability, 122, 200, 360
- Controller area network (CAN)
 - bus, 89, 114–121, 237, 265
 - firewall, 115
 - output signal, 115
 - data message structure, 117
- Cookies, 249
- Core
 - animation, 392
 - graphics, 391
 - OS layer, 391
 - process, 59, 390
 - service layer, 391, 392
- CoRide App
 - data flow diagram, 408
 - use case diagram, 406
- Correlation process, 293
- Cost
 - driver, 22
 - efficiency, 115, 126, 383
 - management, 46
 - pressures, 19, 49
 - reduction, 46, 63
 - structure, 34, 450, 451, 456
 - of conventional vehicles, 451
 - of electric vehicles, 451
- Covariance matrix, 342
- C-program, 181, 398
- Cradle[®] software tool, 186, 187
- Crash avoidance system, 302
- Crime incidents in ridesharing, 461, 476
- Crosswind stabilization (CS), 97
- Customer
 - analysis, 46
 - identification, 46, 221
 - mobility support, 220
 - profile, 111, 221
 - relationship management (CRM), 238
 - requirements, 46, 62, 379
- Cutting-edge
 - innovation, 1, 2, 6, 7, 28, 589
 - technology, 4, 28, 273
- Cyber
 - attack, 25, 228, 266, 268, 271, 293, 304, 307, 309, 328, 329, 331, 340, 368, 439, 453–456, 461, 462, 478, 496, 497, 567, 569, 570, 572, 582
 - surfaces, 331, 332, 453, 454, 582
 - threats, 496
 - components, 172, 177, 206, 257, 271, 295, 318

- crime, 266, 281, 453, 462
 - criminal attack, xiii–xv, 19, 266, 267, 278, 279, 282, 283, 288, 289, 295, 297, 318, 327, 328, 330, 332, 333, 358
 - characteristics, 279, 283, 293, 327
 - classification, 277
 - taxonomy, 326, 370
 - physical system (CPS), 9, 10, 29, 85, 86, 125, 164, 171, 173–197, 199–206, 209, 257, 258, 265–269, 271, 280–283, 294, 295, 300, 308, 309, 316–324, 326, 328, 332, 336–338, 345, 354, 360, 362, 582
 - architecture, 316
 - concept map, 179, 180
 - design recommendations, 180, 181, 183, 184, 258
 - requirements, 176, 184–188
 - risk, 303, 566
 - security, 5, 35, 241, 272, 280, 305, 311, 325, 328, 339, 368, 369, 455, 462, 478, 485, 496, 503, 504, 506, 514, 572
 - security approach, 267, 311, 318, 463
 - security audit, 294
 - security risk, 86, 270–272, 293, 294, 328, 330, 332, 369, 454, 478
 - security solutions, 303, 309, 317, 338, 496, 514
 - space, 266, 274, 282
 - threats, 303, 485, 496, 503, 514, 569
 - weapon, 318
- D**
- Daimler
 - AG, 46, 441
 - Benz, 46, 525
 - Bharat Benz, 16, 30
 - Car2Go, 439–442, 444–446, 448, 449, 451–457
 - Damage of functioning, 265, 266
 - Dashboard
 - modifications, 305
 - Data
 - centric approach, 174, 186, 302
 - cleanup, 204
 - distribution service (DDS), 565
 - flow diagram (DFD), 408
 - glove, 57
 - link layer, 115
 - security, 56, 202, 230, 243, 266, 270, 357–360, 504
 - tracker, 57
 - tsunami, 4
 - Database
 - map, 409, 412
 - system, 62, 382
 - transactional, 409
 - DC-DC converter, 450
 - DDOS attack, 343, 478
 - Decentralized learning algorithm, 291
 - Decision-making, 46, 68, 71, 157, 277, 287, 290
 - Decryption, 352, 353, 355, 356
 - Deep
 - belief networks (DBN), 281
 - learning (DL), 265, 281
 - neural network (DNN), 265, 272, 281, 504
 - Defective
 - operation, 270, 295
 - Defense advanced research projects agency (DARPA), 365
 - Deliverables, 47, 48, 65, 66, 148, 149, 315
 - Delphi, 31, 247, 517
 - Denial-of-service (DOS)
 - attack, 340, 354
 - Denso, 3, 31, 159–161
 - Dependency graph
 - method, 293, 294, 301
 - Depth information, 556
 - Design
 - control, 66, 176
 - release management, 65
 - Detect, 62, 65, 96, 97, 99, 100, 103, 104, 108, 112, 124, 152, 154, 155, 157, 160, 206, 214, 251, 266, 270, 278, 287, 289, 291, 296, 300, 301, 303, 326, 348, 352, 355, 463, 474, 478, 490, 497, 499, 500, 503, 516, 517, 522–524, 530, 533, 534, 536, 537, 542, 544, 546
 - Detection of moving objects, 533, 535, 536, 543
 - Detector, 57, 190, 300
 - Development, 1, 45–78, 83, 172, 266, 379, 384, 466, 488, 513, 581
 - Devices
 - home, 179
 - mobile, 163, 179, 207, 243, 244, 247, 249, 359, 389
 - personal, 179
 - security, 179
 - wearable, 179

- Diagnostic
 - instruments, 35
 - tests, 133
 - Didi, 462–466
 - Digital
 - analog-converter (DAC), 173
 - archive, 69
 - ecosystem, 583, 586
 - factory, 29
 - information, 58, 97, 172
 - manufacturing, 66
 - maps for fully autonomous driving, 254–257
 - mock-up (DMU), 54, 55, 57
 - model, 58
 - platform, 335, 586
 - prototyping (DP), 54
 - solution, 231, 233
 - transformation in vehicles, 222, 303, 304
 - Digitization, 1, 2, 58, 163, 245, 267, 269
 - Dijkstra algorithm, 175, 257
 - Direct physical access, 330
 - Discontinuities in flow, 539
 - Disrupt
 - communication, 265, 266
 - impact, 28, 590
 - Distraction, 231, 473, 516, 549
 - Distributed denial of service (DDOS), 343, 454, 499
 - Disturbance, 103, 189–191, 267, 325
 - Dongfeng, 16, 31
 - Door
 - control unit (DUC), 321
 - locking mechanism, 84
 - Drive
 - by-wire, 116, 332
 - slip control, 126
 - train, 141, 450, 570
 - Driver
 - alcohol detection system for safety (DADSS), 95
 - assistance electronic, 83, 87, 94–98
 - assistance system (DAS), 5, 28, 94, 126, 153
 - drowsiness detection (3D), 97, 514, 516
 - error, 150, 516
 - license, 23, 411, 477, 549, 559
 - Driving
 - conditions, 149
 - phase, 443, 445
 - profile, 250
 - worthiness wizard, 226
 - Drones, 2, 6, 570
 - Drowsiness, 97, 514, 516
 - dSpace
 - I/O boards, 139
 - SCALEXIO, 140
 - simulator, 138–140
 - Dynamic
 - pricing, 465
 - systems development method (DSDM), 129
 - Dysfunctional sensor processing, 309
- E**
- E-
 - call, 8, 251
 - CarTec, 23
 - mobility, 3, 21, 23, 504, 585, 588
 - plate recognition, 4
 - Eavesdropping, 317, 325, 331, 351, 352, 359, 371
 - Economy of scale, 63, 74
 - Ecosystem, 8, 34, 35, 236, 269, 302–304, 350, 379, 390, 491, 550, 583, 585
 - Edge
 - detection, 513, 528, 530, 533, 534, 545, 546
 - detection algorithm, 546
 - E/E
 - architecture, 110–114, 126, 132, 142, 143, 311, 502, 561, 562
 - multifunctional components, 114
 - systems, 9, 26, 28, 45, 86, 89, 95, 109–111, 127, 132
 - Effective reproductive rate, 285
 - Electric
 - brake distribution, 93
 - car, 21, 22, 24, 34, 441, 447–450, 452, 453, 455, 496, 584, 585, 589
 - components, 450
 - drive, 2, 21, 23, 139, 140, 583, 584
 - drive train technology, 21, 584
 - power management, 449
 - power train, 5, 21, 47, 139, 449, 585
 - propulsion, 20
 - vehicle, 13, 19, 20, 33, 34, 97, 163, 439, 447–451, 495, 504, 585, 589
 - vehicle models, 23
 - vehicle warning sound (EVWS), 97
 - Electromagnetic
 - compatibility (EMC), 118, 230, 336
 - discharge (EMD), 118
 - interference (EMI), 118
 - signal, 57

- Electronic
 - brake control module (EBCM), 320
 - control unit (ECU), 92, 98, 99, 111, 113, 116, 117, 126, 127, 129, 131–140, 144, 145, 160, 281, 305, 308, 312, 319–323, 333, 362, 453, 561, 563
 - horizon, 255, 256
 - license plate (ELP), 307
 - meeting tools, 68
 - mirrors, 83
 - power steering (EPS), 100
 - seat adjustment with memory (ESAM), 94
 - solid-state nonvolatile storage medium, 98
 - stability control (ESC), 93, 100, 127, 154
 - stability program (ESP), 93, 332, 550
 - E-mail attachment, 297
 - Embedded computing
 - power, 28
 - systems (ECS), 178, 179
 - Emergency
 - assist (EA), 97
 - phase, 445
 - warning system, 215
 - Emission, 2, 3, 13, 19–23, 71, 117, 163, 225, 246, 271, 448, 584
 - Encryption algorithm, 352
 - Engine control module (ECM), 98, 99, 321, 323
 - Engineering staff, 45
 - Enterprise resource planning (ERP), 62, 66, 67, 238, 382
 - Entertainment
 - features, 226, 334
 - online, 251
 - Entity-to-entity-oriented IoT applications, 208
 - Entry media and navigation system (EMNS), 149, 316
 - Epidemic theory, 265, 272, 284–287
 - Erasable programmable read-only memory (EPROM), 98
 - Error
 - configuration, 292
 - covariance, 283, 284
 - detector, 190, 191
 - magnitude, 540
 - ERTICO-ITS Europe, 256
 - Essential unified process (EssUP), 129
 - Estimated time to arrival (ETA), 466, 474
 - Ethernet, 111, 116, 119, 126, 128, 147, 230, 237, 336, 503, 561, 563
 - Ethical
 - difficulties, 559, 560
 - issues, 28, 569, 586
 - questions, 246
 - Europe, 14, 16, 17, 20–23, 71, 86, 123, 236, 249, 252, 361, 440, 441, 486, 558
 - European union (EU), 172, 231, 256, 441
 - E-vehicles, 163, 228
 - Everything-as-a-service (EaaS), 238
 - Evolutionary
 - algorithm, 113, 275, 276, 279
 - phase, 45, 73
 - Exchange standard of product model data (STEP), 66
 - Exclusive OR operation (XOR), 352, 353
 - Exfiltration of data, 270
 - Exhaust gas recirculation (EGR), 99
 - Extended markup language (XML), 130, 187, 219, 395, 404, 413, 416–418, 420, 421, 423, 427
 - Extreme programming (XP), 129
- F**
- Facebook[®]
 - client, 252
 - Failure
 - mode and effects analysis (FMEA), 123, 124, 361
 - mode and effects and criticality analysis (FMECA), 123, 124, 166, 361, 362
 - routing unit (FRU), 140, 141
 - Fake accounts, 462, 478
 - False
 - negative, 205, 317
 - positive, 205, 279, 289, 300, 317, 340, 498, 503
 - Fatal
 - road accidents, 27
 - traffic accidents, 26
 - Fault
 - detection and localization, 301
 - diagnostics, 301
 - insertion unit (FIU), 135, 139–141
 - tolerance, 150, 174
 - Feature-driven development (FDD), 129
 - Feedback loop, 176, 190, 192
 - Fiat Chrysler, 34, 368
 - Finite element model (FEM), 50, 67
 - First come first serve principle, 405, 406
 - 5G-based services, 241
 - Fixed grid, 539
 - Flash memory chip, 98
 - Flat network architecture, 174, 257
 - Fleet
 - dispatching, 202
 - routing, 202
 - tracking, 202

- Flexibility, 3, 19, 24, 63, 139, 213, 269, 279, 304, 440, 552, 561, 569, 586
 - FlexRay, 111, 115, 118, 119, 126, 128, 310, 336
 - Flooding, 173, 175, 272, 280
 - Ford, 34, 145, 175, 239, 257, 266, 334, 335, 365, 367
 - Forecast, 3, 25, 63, 163, 201, 208, 224, 239, 241, 589
 - Forward-looking cameras, 156
 - 4G-based services, 241
 - Framework for automotive cybersecurity best practices (FACBP), 304
 - Fraud, 246, 291, 330, 461, 462, 474, 478
 - Free
 - floating car sharing, 440
 - form entities, 52
 - ways, 516
 - Freightliner, 30
 - Frugal engineering, 583
 - Fuel
 - cells, 585
 - prices, 14
 - Functional
 - audit, 125, 362
 - capability, 55
 - needs, 59, 185
 - performance test, 348
 - safety, 10, 29, 83, 95, 120–127, 132, 166, 265, 350, 360–362, 371, 386, 514, 563, 566–570, 572, 583, 588, 590
 - measures, 121
 - and security, 303, 350–362
 - security testing, 265, 337
 - Functionality
 - undisturbed, 126
 - Fuso, 30
 - Fuzzy
 - and penetration testing, 265, 337
 - sets, 276, 279
- G**
- Game
 - controller, 392
 - theory, 175, 265, 272, 287, 289, 300, 311, 369
 - Gateway, 113, 116, 167, 234, 235, 237, 240, 259, 281, 323, 333, 340, 350, 502, 556
 - Gaussian Markov random field (GMRF), 301
 - Gaussian random variables, 301
 - General motors (GM), 3, 30, 71, 247, 335
 - Generalization notation, 185
 - Generic cyber-attacks life cycle, 271
 - Genetic algorithm (GA), 277, 279
 - GENEVI
 - alliance, 83, 147, 171, 247–249, 260, 314
 - Geo location, 446
 - German
 - academy for science and engineering (acatech), 172
 - automotive trust report (DAT), 26
 - Federal Ministry of Education and Research (BMBF), 153, 172
 - Germany, 13, 14, 17, 19, 21, 26, 33, 203, 230, 247, 252, 382, 440, 441, 486, 558–561, 585
 - Global
 - footprint, 30
 - navigation satellite system (GNSS), 217, 218, 222, 237
 - positioning system (GPS), 96, 215, 217, 218, 236, 252, 254, 255, 321, 362, 412, 443, 446, 454–456, 462, 465, 475, 506, 552
 - sales, 3
 - vehicle production, 3, 14
 - Global automotive market, 13, 14, 30, 37
 - Global positioning system (GPS), 215, 217, 218, 236, 252, 254, 255, 321, 362, 412, 443, 446, 454–456, 462, 465, 475, 506, 552
 - Global System for Mobile Communications (GSM) connection, 25, 395, 439, 446
 - Go/kill decisions, 49
 - Google
 - autonomous car, 25
 - local search, 252, 253
 - maps, 224, 249, 409, 412, 415, 417
 - street view, 34, 252
 - Government
 - policies, 461, 477
 - policies for ridesharing, 461, 477
 - GrabTaxi, 463
 - Graph theory, 265, 272, 291
 - Graphic user interface (GUI), 390, 395, 404, 417, 420, 423
 - Gyroscopic device, 100
- H**
- Hacked and compromised accounts, 478
 - Hackers, 330, 338, 362, 454
 - Hacking
 - user accounts, 454

- Hand
 - free cell phone interface, 215
 - over, 29
 - Hard-real time system (HRTS), 119, 188
 - Hardware-in-the-loop (HIL)
 - platform, 137
 - test, 83, 133–142, 166, 582
 - Hash functions for message authentication code (HMAC), 324
 - Hazard, 97, 121, 152, 153, 157, 215–217, 231, 235, 246, 249, 256, 268, 269, 360, 365
 - Head mounted display (HMD), 57
 - Health-check phase, 445
 - Heating, ventilation, air control (HVAC), 87, 94, 236
 - Herd immunity, 285
 - HERE
 - digital maps for fully autonomous driving, 254–257
 - hazard warnings, 257
 - on-street parking, 257
 - real-time traffic, 256
 - road signs, 255, 257
 - Heterogeneity in CPS design, 181
 - Heterogeneous traffic, 29
 - Heuristic based detection, 296
 - Hewlett-Packard (HP), 35, 584
 - High
 - definition maps, 550
 - fidelity mapping, 156
 - precision maps, 254
 - speed Ethernet bus system, 561
 - tech companies, 7, 28, 571, 585
 - throughput, 204, 561
 - High-definition (HD) maps, 29, 241, 253, 255, 556
 - Highly automated driving (HAD), 28, 147, 251, 256, 259, 558, 571
 - Hill descent control (HDC), 93, 97
 - Holistic
 - approach to security, 355
 - cybersecurity solutions, 309
 - perspective on security, 272
 - security approach, 310
 - Homogeneous
 - control polygon vertices, 53
 - polygonal control vertices, 52
 - Honda, 71
 - Horizon 2020 program, 172
 - Horns optical flow algorithm, 538–542
 - Hough transform, 531, 545
 - Huawei, 388
 - Human-machine interface (HMI), 34, 35, 151, 178, 227, 258, 432, 442, 506, 513
 - Hypertext markup language 5 (HTML5), 225, 230, 259, 395
 - Hyundai, 16, 30, 468, 585
- I**
- IBM
 - DB2 database, 383
 - WebSphere application server, 383
 - Identifiability, 200
 - Identity
 - and access management (IAM), 239
 - theft, 462
 - IEC 61508, 120, 122, 127, 132, 360, 361
 - IEC 61508-1:2010, 122
 - IEC 61508-2:2010, 122, 123
 - IEC 61508-3:2010, 122
 - IEEE 802.11i wireless local area network standard (WLAN), 215, 319
 - IEEE 802.11 wireless network standards, 319
 - Image
 - analysis, 523, 525, 526, 544, 583
 - detection, 513, 526, 528, 530, 533, 534, 545, 546
 - processing, 28, 95, 513, 525, 526, 528, 531, 533–535, 542, 544–546, 552, 569, 583, 586
 - Impact analysis, 65
 - Impairment test, 348
 - In
 - build camera, 489
 - built functions, 542, 545
 - car wifi, 237, 241, 367, 471
 - Incentive points, 405–407
 - Incubator, 35
 - Independent repair shops, 19, 365
 - India, 14, 16, 17, 382, 388, 462, 465, 471, 472, 475, 477, 478, 583, 584, 586
 - Information
 - and communication technology (ICT), 5, 172, 177, 183, 187, 316, 356, 362
 - imperfect, 290, 291
 - perfect, 290
 - technology (IT), 5, 9, 29, 34, 58, 67, 126, 215, 225, 230, 232, 234, 238, 240, 249, 251, 266–268, 281, 302–307, 316–324, 326, 328, 337, 349, 379–383, 387, 405, 431, 466, 485, 486, 550, 560, 582, 585, 590
 - technology landscape, 381, 382, 387

- Information technology (IT)
 - cloud, 238
 - landscape, 381, 382, 387
- Infotainment
 - components, 83, 171
 - technology, 9, 171, 214, 234, 305, 316, 379, 397
- Infrared camera, 156
- Infrastructure
 - as-a-service (IaaS), 238, 239, 360
 - mode, 344
- Initial checking, 535, 536
- Injecting malware, 478
- Innovation
 - cutting-edge, 1, 2, 6
 - evolutionary, 3
 - revolutionary, 3
- Insiders, 288, 330, 358
- Institute of electrical and electronic engineers (IEEE), 9, 59, 72, 76, 95, 101, 151, 183, 305, 319, 344, 351
- Insurance, 19, 24, 28, 203, 214, 220, 231, 236, 247, 302, 440, 441, 476, 477, 479, 560, 569, 585, 586
- Integrated
 - analysis, 48
 - development environment (IDE), 379, 382, 383, 393–395, 413
 - telematics system, 252
- Integration
 - of car and smart home, 384
 - test, 133, 139
- Integrity check value (ICV), 352
- Intelligent
 - control, 84
 - emergency call (IEC), 251
 - headlight control (IHC), 152
 - parking assistance, 497, 514
 - vehicles, 7
- Intercept, 267, 317, 353
- Interest rate, 14
- Interfaces and data exchange, 66
- Interior design, 47, 552, 555
- International
 - electrotechnical commission (IEC), 72, 116
 - road traffic regulation, 558
 - standard organization (ISO), 59, 66, 72, 73, 75, 76, 95, 114–123, 127, 129, 132, 151, 220, 324, 336, 360, 361
- Internet
 - and apps, 252
 - browser, 253
 - control message protocol for IPv6 (ICMP-IPv6), 314
 - enabling technologies, 6, 208–210, 241
 - of-everything (IoE), 4, 178, 179, 241
 - of-things (IoT), 1, 85, 171, 173, 177, 202, 206–210, 214, 222, 239, 241, 288, 303, 488, 491, 504, 582
 - of-things roadmap, 209
 - protocol v6, 202
 - services, 208, 225, 252
- Interoperability
 - semantic, 187
 - syntactic, 187
- Intersection
 - assistance (IA), 97
 - support (IS), 152
- Inter-vehicle network, 10, 332, 333
- Intrusion
 - detection, 4, 19, 265, 281, 282, 284, 291, 300, 323, 324, 340–343, 345, 347, 348, 350, 455, 463, 503, 569, 582
 - detection and prevention systems (IDPS), 25, 278–280, 305, 342, 343, 345, 502
 - architecture, 346, 502
 - tasks, 345
 - types, 343
 - detection systems (IDS), 291, 497, 502, 503
 - prevention technologies, 343
- In-vehicle
 - comfort, 6
 - information systems, 86
 - infotainment (IVI), 101, 222, 314
 - networking, 95, 237
 - software, 148, 315
 - types and their detection, 94
- Invested cash flow, 46
- iOS
 - architecture, 390
 - platform, 390
 - programming model, 391
- iPod, 34, 333, 390
- ISO 11898-2:2003, 116
- ISO 26262, 10, 95, 120, 122, 127, 132, 151, 360
- ISO/DIS 26262, 120
- ISO/IEC 12207:2008, 75
- ISO/IEC 15288, 72, 75, 76
- ISO/IEC 15288:2002, 72, 75
- ISO/IEC 15504-2, 75
- ISO/IEC 29148 (ISO/EIT 2011), 59
- ISO/IEC JTC1/SC7, 72
- ISO/IEC TR 24748, 76
- ISO/TS 15143-3:2016, 220

J

Japan, 14, 17, 22, 83

Java

Enterprise application, 383

K

Karma, 33

Kinematic systems, 55

Knot vector, 54

Knowledge

flow, 56

meta, 64

sharing, 58

L

LabVIEW, 131

Lane

change assistant (LCA), 153, 162, 253, 516

departure warning (LDW), 98, 253, 516

keeping assistant (LKA), 153, 162, 516,
518, 520, 522

keeping system (LKS), 586

Laplace transform, 198

Large-scale engineering (LSE), 60

Last mile route, 250

Lateral acceleration sensor (LAS), 100

Layer

localization, 255

physical, 116, 118, 119, 230, 356

Legacy functionality, 132

Legal enforcement, 143, 311

Level

of-abstraction, 181

of-detail (LOD), 46, 54

of-innovation (LOI), 60

Liability, 188, 220, 337, 473, 513, 558–560,
569, 586

Lidar, 156, 157, 159, 517, 525, 552

Life cycle

management, 10, 45, 61, 69, 70, 73, 121,
125, 241, 362

process, 59, 72, 75, 76, 311

Light imaging detection and ranging (LiDaR),

95, 156–159, 162, 243, 244, 254,
255, 556

Likelihood, 121, 265, 267, 268, 293

Lines-of-code (LOC), 127, 148, 315, 330, 385,
386, 417

Link layer protocol, 116

LINUX

container (LXC), 398

container resources, 398

foundation, 248

Livelock, 175

LLVM compiler framework, 404

Local

area network (LAN), 95, 215

hazard warning (LHW), 153, 159, 162

interconnect network (LIN), 89, 90, 111,
115, 118, 119, 126, 128, 322

Locating tracking, 351

Logical database requirements, 409

Long-term profitability, 46

Loss of control, 70, 93, 497, 521, 566

Low-power wireless personal area network
(LoWPAN), 202

Lyft, 462–466, 474, 476

M

Machine

learning, 1, 4, 239, 273, 277, 282, 390, 488,
550, 552, 566, 586

to-machine (M2M), 221, 222, 455

to-machine protocol, 448

Magna, 3

Magneti-marelli, 247

Mahindra, 16

Main software (MSW), 144, 312

Maintenance

cost, 29, 89, 112, 132, 175, 217, 343, 382,
383

Mal

function, 521

ware, 306

Malicious

attempts, 265, 267, 294, 295

cyber-criminal attack, 265–267, 278,
281–283, 288, 294–297, 300, 318,
330, 332, 333, 358

files, 296, 297, 333

file types, 297

software intrusion, 265, 266, 278, 291, 295,
332

Management

change, 60, 64, 65, 67, 121, 360

configuration, 65, 66, 71, 123, 132, 134,
292, 337

of dispersed teams, 68

engineering change, 65

inventory, 62

product structure, 54, 64, 65

program, 65, 71, 360, 379

Man-in-the-middle attack (MITA), 272, 309,

317, 339, 497

Manufacturing, 1, 6, 7, 14, 16, 17, 27–31, 33,

34, 46, 47, 54, 56, 62–67, 70–72, 74,
100, 104, 105, 117, 120, 123, 127,

- 129, 143, 145, 147, 178, 218, 229, 232, 302, 304, 311, 313, 333, 334, 379, 383, 384, 388, 389, 397, 431, 432, 440, 448, 463, 502, 517, 557, 559–561, 587, 589
- Market
 - launch, 34, 56, 62, 70, 73, 74, 164, 231, 315, 379, 389, 452, 471
 - penetration, 22, 70, 74, 86, 222, 466
 - volume, 74, 227, 589
- Marketing and sales, 55, 62
- Markov
 - model, 121, 301
 - random field, 301
- Maruti Suzuki, 16
- Mass hacking, 330
- Material requirements planning (MRP), 65
- Mathematical model, 84, 131, 191, 200
- MATLAB[®]
 - image processing toolbox, 545, 546
 - Simulink[®], 131, 200, 513, 543, 544, 552, 569
- Maturity, 45, 47, 49, 55, 57, 73, 74, 86, 171, 229–231, 581
- Mean
 - shift tracking algorithm, 534, 535
 - time between failure (MTBF), 123, 361
 - time to dangerous failure (MTTF_d), 123
- Measuring software quality, 146
- Mechatronic
 - product features, 83
 - system, 83–86, 100, 133, 134
- Media
 - and content delivery network, 240
 - oriented systems transport (MOST), 322
- Medium access control, 351
- Mega cities, 584
- Mercedes
 - benz, 33, 115, 252, 253, 257
 - COMAND[®] online, 171, 252–254, 582
 - emergency call center, 252
 - intelligent drive system, 253
- Message authentication code (MAC), 324
- Metropolitan area network (MAN), 119
- Microprocessor (μP), 99, 147, 244
- Microsoft
 - azure, 239, 504
 - embedded platform, 395, 446
 - SQL server, 383
 - Windows, 239, 318, 337, 389, 390, 404, 447
- Middleware, 66, 147, 180, 204, 206, 229, 248, 382, 383, 514, 552, 561–566, 569, 583
- Miller and Valasek
 - physical hack, 365
 - remote hack, 367
- Mindmap, 516, 518, 519, 553
- Minimization problem, 542
- Minimized resource consumption, 127
- Misdirection access, 330
- Mission critical
 - automotive components, 266, 342
 - ECU components, 308
- Misuse intrusion detection, 341
- Mitigation of cyber attacks, 439, 453, 454
- Mobile
 - ad hoc network (MANET), 95, 303, 351
 - device-centric cloud computing, 359
 - office, 249, 250
- Mobility, 269
 - as-a-service (MaaS), 8, 241
 - on demand, 2, 19
 - management, 8, 209, 216, 226, 235, 379, 582, 585
 - services, 2, 7, 8, 225, 231–233, 239, 256, 267, 269, 384, 589
- Model
 - based development, 45, 127, 130–132, 146
 - based software development, 83
 - of intent, 288
 - in-the-loop testing (MIL), 131, 151
- Modularity of automotive software, 143, 312
- Modularization, 10, 45, 63, 64, 110, 569, 586
- Morphological
 - operation, 526, 531, 532, 534, 546, 547
 - operator, 546, 547
- Motorola
 - droid, 240
- Multi
 - brand vehicle model line, 45
 - dimensional settings, 61
 - hop, 107
 - lateration, 307
 - layer perceptron (MLP), 500
 - period usage, 220
 - purpose vehicle (MPVs), 13
 - tasking, 391, 395
 - touch, 391, 395
- N**
- Nash equilibrium, 290
- National
 - highway traffic safety administration (NHTSA), 171, 242, 558
 - instruments fault intrusion unit (FIU), 135

- instruments hardware in the loop test device, 133, 134
- science foundation (NSF), 172
- vulnerability database (NVD), 345
- National Instruments (NI), 116, 134, 137
- Navigation
 - satellite, 217, 218, 222, 237
 - system, 86, 96, 101, 109, 114, 149, 154, 155, 217, 231, 249, 250, 252, 253, 316, 330, 444, 497, 516
- Near field collision warning (NFCW), 153, 159, 162
- Network
 - architecture, 174, 303
 - structure, 174
 - systems, 95, 140, 354
 - technology, 95, 116
 - topology, 106, 173, 175, 355
 - uncertainties, 176
 - vulnerability test (NVTs), 338
- Networked vehicle, 7, 8, 133
- Next
 - generation engineered systems, 172
 - Step operating system, 398
- Next eXPerience (NXP), 31, 517
- Night vision plus (NVP), 153
- Nissan
 - motor company, 71
- Node structure of an artificial neural network, 275
- Noise removal, 536, 537
- Non
 - maximum suppression, 530
 - object based detection, 524
 - rational B-spline basis functions, 52
 - uniform rational B-splines (NURBS), 52–54
- Nvidia, 552

- O**
- Object
 - based approach, 524
 - detection, 159, 513, 523, 524, 533–535, 537, 556
 - management group (OMG), 565
- Object oriented analysis (OOA), 408, 421
- Objective-C, 379, 393, 394, 398, 399, 403
- Observability, 200
- Obstacle
 - and collision warning (OCW), 153
- Off street parking, 486, 490, 503
- Ola
 - auto, 471
 - masked number feature India, 475
 - micro, 468
 - mini, 468
 - price chart, 470
 - Prime, 468
- On-board
 - diagnostics II port, 306, 332, 335, 365, 503
 - diagnostics (OBD), 117, 119, 323, 324
 - sensors, 494, 514, 557
- Online transportation network, 461, 463
- On-street parking, 256, 257, 486, 487, 489, 503
- Ontology
 - concepts, 184, 185
- Open
 - application layer interfaces, 248
 - GL ES, 392
 - location platform, 256
 - loop control system, 190
 - network technology, 85
 - systems interconnection (OSI), 115
 - unified process (OpenUP), 129
 - vulnerability assessment system (OpenVAS), 337, 338
- Operating system (OS), 144, 280, 312, 337, 379, 389–391, 393–395, 398, 407, 412
- OPPO, 388
- Optical flow algorithm, 534–536, 538–542
- Optimization, 35, 60, 77, 89, 111, 113, 131, 146, 201, 202, 207, 216, 226, 275, 277, 279, 290, 404, 462, 544, 545
- Opto electronic display, 35
- ORACLE database server, 383
- Original equipment manufacturer (OEM), 5, 6, 13, 25, 28–32, 35
 - branded workshops, 19
- Origin-destination (O-D) vehicle ride, 250
- Outsiders, 306, 330, 359, 371
- Outside sensors, 494
- Overall product quality, 45, 55
- Over-the-air (OTA)
 - attack, 454
 - update, 241, 309, 335, 566

- P**
- Pair-of-actions, 288
- Pandora[®], 334
- Park
 - house, 486, 490, 492, 494, 496, 497
 - house management system, 496
 - pilot, 514
 - and ride facilities, 486

- Parking
 - app, 210, 488, 489, 504
 - assistance system, 485, 492, 494, 503, 505, 514
 - information, 252, 490
 - maneuver, 96
 - sensor (PS), 98
 - space, 24, 235, 251, 440, 454, 461, 462, 485–491, 493, 495, 496, 503
 - Partition
 - hierarchical, 113, 114
 - Passenger
 - capacity, 47
 - car, 13, 16, 30, 202, 236
 - manufacturing, 143
 - market, 3, 581
 - Passive safety measures, 27
 - Path planning, 497
 - Pedestrian
 - detection, 142, 155, 157, 162, 514, 536
 - protection system (PPS), 155, 159, 162
 - Penetration test, 265, 337, 349, 359, 360
 - Peoplesoft, 380
 - Performance
 - business, 62
 - driving practices, 48
 - Personal learned destinations, 250
 - Peugeot, 63, 233, 247
 - Physical
 - components, 106, 171–173, 178, 265, 266, 271, 272, 294, 295, 318, 362
 - model, 55
 - system requirements, 176
 - Piaconet, 101, 223, 224
 - Platform
 - as-a-service (PaaS), 238, 239, 360
 - strategy, 63, 229
 - Platooning
 - trucks, 154, 245
 - Plug-in hybrid vehicle, 22
 - Pollution load, 20
 - Polynomial
 - curve, 50, 51
 - surface, 50
 - Population dynamics, 285
 - Porsche, 30, 33, 35, 490
 - Positioning, navigation, and timing services (PNT), 97
 - Power
 - control, 86
 - management module (PMM), 89
 - seats, 83
 - train control module (PCM), 321
 - train technology, 19, 21, 47
 - window and door control (PWDC), 90, 91
 - Precision, 59, 102, 103, 157, 253, 254
 - Pre-crash collision and mitigation system (PCCMS), 154, 158, 159, 162
 - Predictably dependable computing systems project, 188
 - Predictive intelligence, 214
 - President's council of advisors on science and technology (PCAST), 172
 - Probability of false alarm, 284
 - Process
 - management, 62, 66, 142
 - modeling, 58, 66
 - Product
 - animation, 55
 - data creation, 62
 - data management concept, 45
 - data management (PDM), 54, 61, 64–67, 69
 - data model, 66
 - development process, 29, 46, 48, 60, 130
 - innovation process, 48
 - life-cycle management (PLM), 45, 61, 69
 - life-cycle (PLC), 45, 48, 56, 61, 69, 86, 120, 126, 142, 228, 311
 - management, 64, 65, 71, 582
 - plant, 47, 56, 63
 - portfolio, 69
 - related cost, 69
 - revenue, 69
 - structure management, 65
 - Progressive access, 330
 - Project phase, 46
 - Prometheus project, 28
 - Protection
 - from malicious intrusion, 164
 - for pedestrians, 27
 - Protocol-oriented programming, 404
 - Prototype iterations, 60
 - PSA Peugeot Citroen, 63, 247
 - Public
 - private partnership (PPP), 172
 - safety access point (PSAP), 236
 - transport, 8, 24, 468, 584, 586, 588
 - transportation, 2
- Q**
- Qualcomm
 - connected car reference platform (CCRP), 237, 238
 - technologies, 237, 238
 - Quality management (QM), 361

R

- Radar, 95, 141, 157–158, 163, 243, 244, 254, 255, 335, 517, 525, 552, 553, 560
- Radio
 - communication, 351
 - detection and ranging (Radar), 95, 96, 141, 156–158, 162, 243, 244, 254, 259, 516, 517, 525, 552
 - frequency identification (RFID), 104, 171, 202–205, 207, 208, 210–214, 218, 258, 306, 442, 453, 490
 - frequency (RF), 157, 205
 - telemetric, 35
- Radio frequency identification (RFID)
 - tag, 202, 204, 212, 306, 453
- Random
 - access memory (RAM), 212
 - hardware failure, 567
 - nonnegative variable, 61
 - uniform variable, 61
 - variables, 61, 290, 301
- Rapid prototyping, 131, 141, 148, 166, 315, 513, 552
- Rate of infection, 286
- Rational B-splines, 51, 52, 77
- Real-time
 - behavior, 126, 127, 150
 - information, 257, 408, 489
 - monitoring, 85, 177, 201
 - operation, 114, 204, 268
 - ride hailing, 465
 - traffic alert, 8
 - traffic information (RTTI), 251, 256, 488, 490
- Rear view system (RVS), 154, 162
- Receivers, 57, 117, 118, 159, 209, 218, 225, 228, 352, 354, 516
- Recursion formula, 51
- Recycling, 56
- Reference input, 189–191
- Release planning, 387
- Reliability, 73, 111, 113, 114, 126, 127, 133, 143, 150, 159, 177, 178, 181, 189, 201, 205, 212, 218, 234, 312, 318, 325, 342–344, 361, 381, 387, 569, 572, 586
- Remote
 - access tunnel, 307
 - car door opening, 34
 - code execution, 366
 - control, 34, 139, 226, 384
 - deactivated critical safety elements, 307
 - diagnostics, 236, 334, 335, 384, 585
 - keyless entry (RKE), 91
 - network access, 271
 - parking, 493, 496, 550
 - procedure call (RPC), 564, 565
 - services, 250, 251, 305
- Renault, 23, 30, 63
- Rental car company, 454
- Repair
 - tear, 17
 - wear, 17
- Repository
 - central, 61
- Requirement
 - analysis and negotiation, 60, 185
 - definition, 187
 - developing a pragmatic taxonomy, 327
 - elicitation, 60, 184, 185
 - engineering, 45, 59, 127, 132, 185–187
 - identification, 60, 185
 - management, 60
 - non-functional, 386, 409, 569, 586
 - real-time, 114, 116, 137, 177, 188, 189, 305, 561
 - specification, 59, 60, 132, 185
 - validation, 60, 185
- Research and development (R&D)
 - budget, 37, 47
- Resilience
 - test, 34
- Resolution, 68, 103, 109, 115, 157, 158, 313, 518, 524, 526, 544, 546
- Resource shortness, 163
- Retrieval management, 65
- Return on investment (ROI), 60, 70
- Reusability
 - of functions, 144, 312
- Reverse engineering, 331, 334, 337
- Ride
 - comfort, 94, 150
 - hailing, 24, 461, 463, 465, 468, 473, 477, 479, 491, 559, 582, 586
 - companies, 462, 463, 468, 491, 559
 - economy, 462
 - share service, 461, 473
 - sharing, 379, 404, 407, 411, 462, 469–471, 473, 475, 477–479
 - app, 405, 475, 582
 - arrangement, 461
 - companies, 461, 464, 476, 477, 479
 - economy, 241, 472
 - platforms, 473, 474, 476
- Risk level
 - identification, 328

- Rivest
 - cipher 4 algorithm, 352
 - Shamir-Adleman encryption/decryption, 356
- Road
 - departure protection (RDP), 154
 - safety, 7, 164, 215, 216, 244, 245, 253, 513
 - side unit (RSU), 2, 98, 235, 302
 - sign recognition (RSR), 154
 - transportation, 201, 216
- Robot operating system (ROS), 565
- Rollover, 521
- Routing
 - algorithm, 174, 175
 - schemes, 174, 175
- Runtime environment (RTE), 144–146, 148, 312
- Rural drive assistance (RDA), 155
- Rush hour, 21

- S**
- Safe
 - distance, 96, 100, 516
 - failure fraction (SFF), 121, 123, 124, 361
- Safety
 - active, 127, 154, 155, 241, 243, 251, 253, 513, 514, 550
 - assistants, 253, 513
 - belt, 26, 100, 154, 514
 - control, 86, 92, 93, 97, 121, 127, 130, 149, 151, 164, 210, 226, 245, 266, 332, 333, 360, 398, 514, 550
 - features, 89, 94, 95, 127, 130, 149, 164, 225, 226, 231, 240, 242, 321, 333, 334, 404, 473, 475, 550, 557
 - function, 88, 89, 120, 127, 130, 150, 151, 226, 398
 - functional, 10, 29, 83, 95, 120–127, 132, 150, 227, 265, 303, 350–362, 385, 566–570, 583, 588
 - integrity level (SIL), 120, 122, 360, 566
 - life-cycle phases, 122
 - passive, 27, 93, 127, 243, 253, 514
 - performance, 28, 35, 111, 121, 130, 360, 404
 - related software, 122
 - requirements, 83, 120, 122, 126, 127, 130, 132, 142, 143, 150, 249, 311, 324, 325, 361
 - in ridesharing, 472
 - risk for ridesharing passengers, 474
 - standards, 10, 28, 89, 95, 120, 122, 123, 127, 132, 229, 231, 350, 360, 361
- Sales documents, 55
- Samsung, 70, 388
- Santa clara law review 1145, 246
- Satellite navigation system, 516
- Scalable software architecture, 552
- Scania, 30
- Scoping, 47
- Scrum
 - development process, 384
 - master, 384
 - project, 384, 385
 - release planning, 387
- SDL suite, 184
- Seat comfort (SC), 91
- Securing automotive mission-critical components, 342
- Security
 - breaches, 309, 549, 567
 - challenges, 265, 266, 303, 304, 350
 - flaws in modern vehicles, 364
 - layers, 203, 355, 356, 383
 - measures, 293, 319, 340, 350, 351, 355, 356
 - objectives and their impacts, 325
 - of data, 7, 323, 324, 357, 569
 - platform, 233, 265, 356, 357
 - procedures, 307
 - view on security, 289
- Self
 - driving, 8, 9, 28, 34, 147, 164, 241, 254, 513, 549, 550, 552, 558–560, 566, 588
 - driving vehicle, 8, 9, 28, 34, 147, 164, 241, 254, 513, 549, 558–560, 566
 - parking, 242
- Semiconductor platforms, 552
- Send to car, 249
- Sensor
 - data fusion, 105, 106, 176, 556
 - network node, 173
 - network security, 355
 - node, 105–109, 118, 173, 174, 178, 213, 271, 272, 280, 317, 325, 354, 355
 - output voltage, 103
 - technology, 28, 83, 87, 102–105, 156, 216, 222
- Sequence diagram, 409, 410
- Sequential structure, 46
- Service
 - delivery, 8, 62, 239, 240, 381
 - discovery, 564
 - oriented architecture (SOA), 230, 561, 583
 - robotics, 28
- Shadow removal, 536, 537

- Shared
 - economy, 8, 220, 233, 472, 487
 - sensor and actuator networks (SANs), 106, 176
 - service centers, 382
- Sharing economy, 8, 220, 233, 241, 472
- Side-channel attack, 309, 339
- Signal
 - processing, 188, 543, 552
 - processing algorithms, 28
- Signature-based detection, 296
- Silicon Valley, 34, 35
- Simple rational B-spline surface algorithm, 52
- Simplex, 51
- Simulink[®], 131, 184, 200, 513, 543, 544, 552, 569
- Simultaneous engineering (SE), 56, 567
- Single vehicle roadway departure, 521
- Skidding control, 110
- Smart
 - car, 46, 439, 449, 454
 - city, 209, 210
 - hardware, 266
 - mirrors and wipers (SMW), 91
 - mobility, 2, 8, 210, 239, 241
 - phone, 25, 70, 209, 225, 227, 231, 252, 462
 - phone market, 388
 - road, 244
 - street lights, 210
 - ticketing, 221
 - traffic signals, 245, 303
 - traffic signs, 245
 - transit systems, 245
 - watch, 8, 34, 35
- Smog, 20
- Sobel method, 530
- Social networks, 223, 249, 287, 301, 462
- SoftBank pepper robot, 35, 36
- Soft real-time systems (SRTS), 119, 188
- Software
 - as-a-service (SaaS), 238
 - based cryptographic methods, 324
 - engineering approach, 182
 - in the loop simulations, 151
 - market volume, 74, 85
 - security, 237, 305
 - sophisticated, 116, 266
- Solutions
 - embedded, 227, 231, 256, 269, 355, 446
 - remote, 227, 496
 - tethered, 227
- Sound pressure level (SPL), 161
- Spare parts, 8, 29
- Spatial orientation, 58
- Spear phishing, 265, 301
- Specific object detection, 537
- Speed
 - control unit (SCU), 321
 - limit, 26, 154, 155, 254, 257, 490, 514
- SPLITVIEW, 252, 253
- Spoofing, 306, 309, 310, 313, 340, 353, 454, 497, 566
- Sport utility vehicle (SUV), 13, 357, 469
- Spreading mechanism, 285, 287
- Sprint
 - network, 367
- SpriteKit, 392
- SQL Server, 383
- Stage gate[®]
 - controlled development process, 45, 48
- Stakeholder
 - needs and requirements (SNR), 59
- Standardization, 63, 72, 116, 127, 143, 145, 215, 220, 228, 231, 248, 312, 313, 566
- Starship delivery robot, 37
- Startup autobahn, 35, 36, 38, 581
- Statemate[®], 184
- Static characteristic, 55, 102, 156, 193, 265, 296
- Statistical
 - analysis, 280, 326, 362, 544, 545
 - hypothesis testing, 301
- Steer-by-wire, 100, 116
- Steering
 - assistance, 492
 - and backing off maneuvers, 492
 - wheel, 93, 96, 100–102, 152, 153, 243, 249, 253, 255, 365, 504, 516, 518, 522, 552, 554, 555
 - wheel angle sensor (SWAS), 100
- Steering wheel, 96, 100–102, 153, 243, 249, 253, 255, 365, 504, 516, 518, 522, 552, 554, 555
- Step response, 194–196, 199
- Stochastic customer arrivals, 220
- Stop-over phase, 444, 446
- Stream cipher, 351–353
- Streetscooter, 585
- Strengths-weaknesses-opportunities-threats analysis (SWOT), 5
- Stress test, 348
- Structural query language (SQL), 187, 239, 383, 413
- Subscriber identity modules (SIM), 231, 250, 252

- Subversion of a node, 355
- Sunroof (SHD), 5, 8, 87, 91, 92
- Supervisory control and data acquisition (SCADA), 107, 177
- Supply chain
 - management, 203, 205, 269
- Surface
 - modeling, 51
 - shape, 50–52
- Surge pricing mechanism, 461
- Surreptitiousness, 283, 284
- Susceptible-infected-recovered model (SIR), 286, 287
- Suspension
 - control unit (SPCU), 321
 - system, 321
- Swatch, 46
- Swift, 379, 393, 398
- Sybil attack, 499
- System
 - identification, 107, 117, 171, 204, 206, 213, 221, 282, 297, 307, 543
 - modeling, 53, 57, 60, 66, 84, 85, 131, 183, 185
 - on-a chip (SOC), 236, 308
 - requirement and specification (SyRS), 59
 - security, 229, 230, 268, 455
 - and software engineering, 59, 69, 177, 182, 185
- Systems, applications, products (SAP), 252, 380, 382, 490

- T**
- Tag
 - active, 211–213
 - characteristics, 211–213, 293
 - passive, 211–213
 - reader, 203–206, 211–213, 453
- Target costing, 46, 70
- Task completion time, 176
- Tata motors, 16
- Taxi
 - aggregation model, 468
 - app, 468
 - ForSure (TFS), 465, 471
- Technological
 - advances, 2, 163, 178, 208, 209, 212, 244, 307, 317, 322, 354, 462
 - features, 4–6, 163, 209, 212, 214, 228, 234, 354
- Telco communication, 462
- Telematics
 - components, 171, 214, 215, 218, 222, 332, 446
 - control unit (TCU), 237, 502
 - market segments, 222, 223
 - technologies, 171, 214, 215, 231, 234
- Temporal key integrity protocol (TKIP), 319
- Tesla
 - giga factory, 22, 589
- Testing, 4, 34, 47, 55, 74, 110, 123, 127, 129, 131, 133, 135, 137–139, 151, 171, 183, 235, 242, 247, 255, 265, 301, 308, 322, 336, 337, 343, 348–350, 360, 395, 561, 582
- Texture, 55, 392, 544
- Threats, 4, 5, 7, 19, 24, 25, 237, 239, 265–270, 272–274, 281, 288, 289, 294, 297, 303, 306, 308–310, 318, 324, 330, 331, 340, 342, 343, 345, 350, 358, 364, 453, 473, 474, 485, 496–497, 503, 504, 514, 566, 569
- Threshold
 - technique, 533
 - theorem, 286
- Tier1 supplier, 5, 28, 31, 35, 45, 46, 56, 62, 115, 142, 143, 149, 156, 225, 227, 228, 233, 240, 247, 248, 308, 311, 315, 360, 431, 493, 502, 517
- Time
 - based intrusion detection, 282, 348
 - of-flight (ToF), 161
 - to-market (TTM), 49, 55, 62, 68, 181, 249
- T₁ microcontroller, 197
- Timing attack, 318, 500
- Tire pressure sensor (TPS), 115
- Topology
 - bus, 112, 561
 - linear bus, 112
 - ring, 112
 - star, 111
- Total error, 540
- Toyota, 3, 30, 35, 71, 334, 365, 367, 468, 469, 581, 585
- Tracking
 - GPS, 217, 218, 236, 474
 - of trailers, 218
 - of trucks, 245
 - of vehicles, 200–202, 204, 218
 - of wagons, 203
- Trade-off
 - parameter, 289

Traffic

- analytics, 490
- congestion, 20, 210, 216, 224, 251, 468
- jam, 20, 152, 203, 249, 254, 461, 462, 468, 557, 587
- light, 4, 29, 152, 164, 210, 216, 235, 244, 245, 255, 556
- message channel (TMC), 96, 224
- mixed, 246, 254
- regulation, 27, 88, 558, 560
- rules and regulations, 559
- sign, 98, 255, 256
- sign recognition (TSR), 98, 142, 155, 514, 525

Train, 5, 24, 304, 450, 570, 586

Transducer, 105, 161

Transfer

- function, 191–193, 200

Transferability of functions, 144, 312

Transmission control

- module (TCM), 99
- protocol/internet protocol (TCP/IP), 206

Transmission control protocol/internet protocol (TCP/IP), 206, 561, 563, 564

Transmitter, 57, 118, 212, 225, 228, 306, 516

Transponder, 211, 213

Transportation

- freight, 2, 28, 202, 217
- passenger, 6, 28, 201, 203
- platform, 28, 407, 490, 586
- system, 8, 19, 98, 200–202, 204, 209, 216, 217, 241, 303

Turnover by revenue, 16

Two-speed IT, 383, 387

Type 2/mode 3, 22

U**Uber**

- driver safety, 474, 475
- Go, 469, 470
- MOTO, 471
- panic button, 475
- price chart, 470
- safety net India, 475
- SUV, 469, 471
- X, 469–471
- XL, 469, 470

Ubiquitous

- computing, 179, 201, 206, 214
- information network, 178

Ultimate disposal phase, 45, 72

Ultra

- precise HD map, 255
- sonic sensor, 160, 161
- sound, 156, 243, 489, 490, 492, 493, 495
- sound warning system, 492

Unauthorized

- access, xiv, 88, 265, 267, 270, 314, 325, 338, 356, 496, 582
- intrusion of a web-based application, 363
- transmission, 351

Unified modeling language (UML)

- profiles requirements validation, 185

Unit step, 194–196

Universal serial bus (USB)

- media playback, 234
- port, 116, 252, 324, 333, 366, 497

UNIX, 331, 390

Unmanned vehicles, 28, 277

Urbanization, 584

USA, 558, 559, 589

Usage-based insurance (UBI), 19, 214, 221, 236, 585

Use cases and architecture of car2go, 442

Utilization phase, 45, 73

V

Valet parking functionality, 454, 493

Validation

- phase, 47

Value

- chain, 19, 29, 35, 61, 62, 208, 228, 230, 233, 307–310, 450, 517, 589
- engineering, 46, 47

Vault, 65, 66

V-diagram, 322

Vehicle

- ad hoc network (VANET), 95, 303
- audio system, 101
- connection, xii, 19, 101, 225, 227, 231, 240, 245, 305, 324, 336, 365, 566
- control module (VCM), 99
- density, 17, 18, 143, 311
- diagnostics, 9, 129, 222, 332
- disabled remotely via web application, 363
- emission, 19, 20, 71
- hacking, 26, 115, 164, 265, 306, 324, 330, 338, 362, 363, 365–368
- liability insurance, 220, 560
- location, 101, 111, 203, 215, 217, 218, 227, 228, 236, 237, 245, 250, 252, 255, 256, 305, 414, 445, 473, 516

- Vehicle (*cont.*)
 - management, 2, 10, 22, 45, 46, 89, 90, 121, 142, 202, 216–218, 222, 226, 235, 241, 271, 307, 321, 334, 362
 - manufacturer, 5, 6, 16, 17, 28, 30, 31, 46, 117, 143, 147, 229, 308, 311, 333, 334, 559–561
 - model, 2, 23, 45–47, 154, 240, 322
 - security risk, 330, 332
 - self-diagnostic, 119
 - to-cloud data, 256
 - to-home (V2H), 215, 216, 244
 - to-infrastructure (V2I), 10, 95, 151, 209, 235, 244, 303, 496, 497, 503, 550, 557, 566
 - to-mobility (V2M), 303
 - to-road (V2R), 215
 - to-vehicle (V2V), 9, 95, 209, 215, 244, 303, 557
 - tracking system, 201–206
 - utilization, 28, 45, 142
 - vehicle communication (V2V), 306, 309, 323, 332, 335
- Vehicular communication system (VCS), 98, 306
- Velocity tracking, 129
- Venture capital firms, 35
- Verification, 60, 66, 71, 132, 151, 186, 283
- Vertex, 54
- Video
 - camera, 152, 154
 - conferencing, 68
- Vienna Convention for road traffic, 495, 558, 586
- Virtual
 - product creation, 10, 29, 45, 64–68, 581, 589
 - prototyping (VP), 54
 - reality (VR), 57, 58
 - space, 58
- Virus
 - activation, 297, 301
 - surrounding, 298
- Vision system, 159, 516
- Visteon, 247, 517
- Visual collaboration tools, 68
- Visualization
 - technique, 57
- Voice control and telephony (hands free), 253
- Volcano automotive group, 115
- Volkswagen
 - diesel gate scandal, 71
 - group, 21, 33, 71
- Volvo, 115, 233
- Vulnerability
 - instances, 292
- Vulnerable
 - access point, 306
 - scanning, 337
- W**
- Warning light, 323
- Wear and tear, 17, 448, 450
- Weather maps, 252
- Web
 - browser, 253, 357, 395
 - radio, 253
- Wet road, 522
- Wheel speed sensor (WSS), 92, 93, 100
- Widget, 395, 417, 420, 423, 430
- Wi-Fi
 - protected access, 319
 - services, 9, 466
- Wind river, 247
- Window lift, 87, 90, 323
- Windows
 - embedded stack, 447
 - phone, 389
- Wired equivalent privacy (WEP), 319, 351–353
 - authentication, 319, 352, 353
 - encryption and decryption, 352, 353
- Wireless
 - access for the vehicle environment (WAVE), 216, 235
 - communication, 9, 88, 95, 107, 173, 202, 207, 213–216, 223, 231, 234, 243–245, 267, 280, 301, 303, 336, 350, 354, 367
 - local area network (WLAN), 95, 215, 319
 - mesh network, 173, 301
 - sensor-and-actuator network (WSAN), 176
 - sensor network (WSN), 106, 173–175, 354–356
 - vehicle safety communication (WVSC), 215
- Wireless local area network (WLAN), 102, 215, 319, 344, 351, 494
- Work
 - flow of repair, 492, 503
 - plan, 46, 48

Worldwide production of cars, 15
Wrong-way driving warning (WWDW), 98

X

Xcode

integrated development environment (IDE),
379, 393, 394
interface builder (IB), 394, 399, 417
programming environment, 393

Y

Yaw rate sensor (YRS), 100
Yelp[®], 334

Z

Zero
days, 318, 454, 566
sum, 290
Zombie detection, 394