UE INDICATION OF UPLINK SCHEDULING PARAMETERS IN WIRELESS COMMUNICATIONS

Abstract

Methods, systems, and devices for wireless communication are described for user equipment (UE) indication of uplink scheduling information to a base station. The uplink scheduling information may provide information on a periodic traffic pattern, such as for periodic extended reality (XR) data flows. The uplink scheduling information may provide uplink assistance information (UAI) to a base station to assist the base station with providing uplink resources that efficiently serve an XR session. The UAI may indicate one or more of a periodicity of uplink traffic, an offset between uplink traffic and a packet arrival, a data size for uplink traffic for each time period associated with the XR session, a request to enable uplink transmission skipping, or any combinations thereof. A base station may provide one or more dynamic grants, configured grants, or proactive grants to a UE based on the uplink scheduling information.

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Background/Summary

CROSS REFERENCES [0001] The present Application for Patent is a continuation of U.S. patent application Ser. No. 17/575,417 by KIM et al., entitled "UE INDICATION OF UPLINK SCHEDULING PARAMETERS IN WIRELESS COMMUNICATIONS," filed Jan. 13, 2022, which claims priority to and the benefit of U.S. Provisional Patent Application No. 63/138,254 by KIM et al., entitled "UE INDICATION OF UPLINK SCHEDULING PARAMETERS IN WIRELESS COMMUNICATIONS," filed Jan. 15, 2021, each of which is assigned to the assignee hereof, and each of which is expressly incorporated by reference in its entirety herein.

TECHNICAL FIELD
[0002] The following relates to wireless communication, including UE indication of uplink scheduling parameters in wireless communications.
BACKGROUND
[0003] Wireless communications systems are widely deployed to provide various types of communication content such as voice, video, packet data, messaging, broadcast, and so on. These systems may be capable of supporting communication with multiple users by sharing the available system resources (e.g., time, frequency, and power). Examples of such multiple-access systems include fourth generation (4G) systems such as Long Term Evolution (LTE) systems, LTE-Advanced (LTE-A) systems, or LTE-A Pro systems, and fifth generation (5G) systems which may be referred to as New Radio (NR) systems. These systems may employ technologies such as code division multiple access (CDMA), time division multiple access (TDMA), frequency division multiple access (FDMA), orthogonal frequency division multiple access (OFDMA), or discrete Fourier transform spread orthogonal frequency division multiplexing (DFT-S-OFDM).
[0004] A wireless multiple-access communications system may include one or more base stations or one or more network access nodes, each simultaneously supporting communication for multiple communication devices, which may be otherwise known as user equipment (UE). These communication devices may support various extended reality (XR) applications, such as augmented reality (AR), mixed reality (MR), and virtual reality (VR). In XR applications, these communication devices may generate and send pose information and other control information to avoid visual conflicts, such as misaligning objects between real and virtual environments, and other visual conflicts. In some cases, transmission of the pose information and other control information by these communication devices may be latency sensitive, where increased latency may result in degraded user experience. It therefore may be desirable to manage communications related to XR applications, among other examples, to provide for reduced latency.
SUMMARY
[0005] The described techniques relate to improved methods, systems, devices, and apparatuses

that support user equipment (UE) indication of uplink scheduling parameters in wireless communications. Various aspects describe communications between a communication devices, such as a UE and a base station (e.g., an eNodeB (eNB), a next-generation NodeB or a giga-NodeB (either of which may be referred to as a gNB)) in which information transmitted by a UE may have a traffic pattern that is based on periodic extended reality (XR) data flows. In some cases, a UE may provide one or more scheduling parameters to a base station to assist the base station with resource allocation for uplink communications associated with an XR session, or other communications session having a periodic uplink traffic flow. In some cases, a UE may provide uplink assistance information (UAI) to a base station to assist the base station with providing uplink resources that efficiently serve an XR session. In some cases, the UAI may indicate one or more of a periodicity of uplink traffic, an offset between uplink traffic and a packet arrival, a data size for uplink traffic for each time period associated with the XR session, a request to enable uplink transmission skipping, or any combinations thereof.

[0006] A method for wireless communication at a user equipment (UE) is described. The method may include transmitting, responsive to an initiation of a traffic session (e.g., an extended reality session) at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and communicating with the base station to transmit or receive data associated with the traffic session based on the uplink scheduling information.

[0007] An apparatus for wireless communication at a UE is described. The apparatus may include at least one processor, memory coupled with the at least one processor, and instructions stored in the memory. The instructions may be executable by the at least one processor to cause the apparatus to transmit, responsive to an initiation of a traffic session at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and communicate with the base station to transmit or receive data associated with the traffic session based on the uplink scheduling information.

[0008] Another apparatus for wireless communication at a UE is described. The apparatus may include means for transmitting, responsive to an initiation of a traffic session at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and means for communicating with the base station to transmit or receive data associated with the traffic session based on the uplink scheduling information.

[0009] A non-transitory computer-readable medium storing code for wireless communication at a UE is described. The code may include instructions executable by at least one processor to transmit, responsive to an initiation of a traffic session at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and communicate with the base station to transmit or receive data associated with the traffic session based on the uplink scheduling information.

[0010] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the transmitting the uplink scheduling information may include operations, features, means, or instructions for transmitting, to the base station, one or more of a UAI communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE. In some examples of the method, apparatuses, and non-transitory computer-readable medium described

herein, the UAI is associated with an extended reality session and includes one or more of a requested periodicity of uplink traffic, a requested offset of uplink traffic, a requested data size for uplink traffic for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof. Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving, from the base station, an uplink scheduling pattern that is based on the UAI.

[0011] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for transitioning to a sleep mode between consecutive uplink grants based on the uplink scheduling pattern. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink scheduling pattern provides that uplink communications to the base station and downlink communications from the base station are coordinated to provide additional duration of the sleep mode relative to cases where UAI is unused in deriving the uplink scheduling pattern.

[0012] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, at least a portion of the uplink scheduling pattern may be received in radio resource control (RRC) signaling. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink scheduling pattern provides one or more of a configured grant for the UE, an enablement of uplink transmission skipping, a sounding reference signal configuration, a channel state information report configuration, a discontinuous reception (DRX) configuration, or any combinations thereof.

[0013] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the enablement of uplink transmission skipping indicates that the UE can skip an uplink shared channel communication when the UE does not have uplink data to transmit. Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving, from the base station, one or more proactive grants for one or more uplink communications and where the uplink scheduling information provides an uplink skipping indication that one or more subsequent proactive grants will be unmonitored by the UE. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication identifies that the one or more subsequent proactive grants will be unmonitored for a first time period or until a specific time. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the first time period or the specific time correspond to a start of a subsequent downlink burst of the traffic session.

[0014] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication is an explicit indication provided in a scheduling request that may be transmitted to the base station. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication may be provided in a medium access control (MAC) control element (CE) in which a buffer status report (BSR) indication is set to zero. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication may be provided by setting an inactivity timer of the UE to a value that initiates a DRX sleep state. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication may be provided in a layer-one request that is transmitted in uplink control information to the base station.

[0015] A method for wireless communication at a base station is described. The method may include receiving, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and communicating with the UE to receive or transmit data associated

with the traffic session based on the uplink scheduling information.

[0016] An apparatus for wireless communication at a base station is described. The apparatus may include at least one processor, memory coupled with the at least one processor, and instructions stored in the memory. The instructions may be executable by the at least one processor to cause the apparatus to receive, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and communicate with the UE to receive or transmit data associated with the traffic session based on the uplink scheduling information.

[0017] Another apparatus for wireless communication at a base station is described. The apparatus may include means for receiving, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and means for communicating with the UE to receive or transmit data associated with the traffic session based on the uplink scheduling information.

[0018] A non-transitory computer-readable medium storing code for wireless communication at a base station is described. The code may include instructions executable by at least one processor to receive, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session and communicate with the UE to receive or transmit data associated with the traffic session based on the uplink scheduling information.

[0019] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink scheduling information includes one or more of a UAI communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the UAI is associated with an extended reality session and includes one or more of a requested periodicity of uplink traffic, a requested offset of uplink traffic, a requested data size for uplink traffic for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the UAI includes one or more of a requested periodicity of uplink grants, a requested offset of uplink grants, a requested data size for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof.

[0020] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for transmitting, to the UE, an uplink scheduling pattern that is based on the UAI. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink scheduling pattern provides that uplink communications from the UE and downlink communications to the UE are coordinated to provide additional duration of a sleep mode at the UE relative to cases where UAI is unused in deriving the uplink scheduling pattern. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, at least a portion of the uplink scheduling pattern may be transmitted to the UE in RRC signaling. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink scheduling pattern provides one or more of a configured grant for the UE, an enablement of uplink transmission skipping, a sounding reference signal configuration, a channel state information report configuration, a DRX configuration, or any combinations thereof.

[0021] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the enablement of uplink transmission skipping indicates that the UE can

skip an uplink shared channel communication when the UE does not have uplink data to transmit. Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for transmitting, to the UE, one or more proactive grants for one or more uplink communications associated with the traffic session, and where the uplink scheduling information provides an uplink skipping indication that one or more subsequent proactive grants will be unmonitored by the UE and discontinuing transmitting the one or more proactive grants to the UE responsive to the uplink skipping indication.

[0022] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication identifies that the one or more subsequent proactive grants will be unmonitored for a first time period or until a specific time, and where the transmitting of the one or more proactive grants are discontinued for the first time period or until the specific time. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the first time period or the specific time correspond to a start of a subsequent downlink burst of the traffic session.

[0023] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication may be an explicit indication provided in a scheduling request that is received from the UE. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication may be provided in a medium access control (MAC) control element (CE) in which a BSR indication is set to zero. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication may be provided by setting an inactivity timer of the UE to a value that initiates a DRX sleep state. In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the uplink skipping indication may be provided as a layer-one request that is transmitted in uplink control information from the UE.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIGS. **1** and **2** illustrate examples of wireless communications systems that support UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0025] FIGS. **3**A and **3**B illustrate examples of transmission configurations that support UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0026] FIGS. **4** and **5** illustrate examples of downlink control channel and uplink shared channel communications that support UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0027] FIG. **6** illustrates an example of a process flow that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0028] FIGS. **7** and **8** show block diagrams of devices that support UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0029] FIG. **9** shows a block diagram of a communications manager that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0030] FIG. **10** shows a diagram of a system including a device that supports UE indication of

uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0031] FIGS. **11** and **12** show block diagrams of devices that support UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0032] FIG. **13** shows a block diagram of a communications manager that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0033] FIG. **14** shows a diagram of a system including a device that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

[0034] FIGS. **15** through **20** show flowcharts illustrating methods that support UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure.

DETAILED DESCRIPTION

[0035] Some wireless communication systems may include communication devices, such as UEs and base stations (e.g., eNBs, next-generation NodeBs or giga-NodeBs (either of which may be referred to as a gNB)) that may support multiple radio access technologies. Examples of radio access technologies include 4G systems such as LTE systems and 5G systems which may be referred to as NR systems. Communication devices in such systems may support various extended reality (XR) applications, such as augmented reality (AR), mixed reality (MR), and virtual reality (VR). Various types of XR applications may have periodic or semi-periodic data traffic, such as periodic traffic that is associated with pose information. The applications may be hosted by a server as described herein. The server may transmit the periodic or semi-periodic downlink data traffic to a base station, which may forward the downlink data traffic to the UE, and the UE may transmit the periodic or semi-periodic uplink data traffic to a base station, which may forward the uplink data traffic to the server.

[0036] In XR applications, features from the real and virtual environments may be overlaid and displayed to a user for consumption via the UE. To avoid visual conflicts, such as misaligning objects from the real and virtual environments, and other visual conflicts, the UE may sense, generate, and send pose information to a network (e.g., a base station, a server hosting the XR application). The pose information may define a position and orientation of the UE (or user) in space relative to the real and virtual environments. The UE may send the pose information and/or other control information according to a periodicity that is associated with a frame rate of an XR application. In some cases, the UE may be provided with a configured grant that may allocate periodic resources (also referred to as configured grant resources), which the UE may use for downlink reception or uplink transmission, or both. Configured grants may be provided, in some cases, in radio resource control (RRC) signaling. In other cases, the base station may provide dynamic grants to the UE, which may be based on a scheduling request (SR), a buffer status report (BSR), or combinations thereof, that may be transmitted by the UE. In further cases, the base station may provide proactive grants (PGs) to the UE based on expected uplink data to be transmitted by the UE, and PGs may be dynamically indicated by the base station without an SR indication.

[0037] In order to provide sufficient uplink resources the base station may need to be aware of one or more parameters associated with XR traffic of the UE. In accordance with various aspects as discussed herein, a UE may provide one or more scheduling parameters to a base station to assist the base station with resource allocation for uplink communications associated with an XR session. In various traditional wireless communications systems, a UE may be unable to explicitly provide such uplink scheduling parameters, and such systems instead provide for indication of a buffer status at the UE through a BSR, SR, or a quality of service (QOS) indication associated with

different communications types, or combinations thereof. However, such techniques may not provide a base station with an indication of a traffic pattern at the UE, which may be helpful in timing and data quantities for resource allocations for uplink communications from the UE. In some aspects, the present disclosure provides that a UE may indicate a preferred uplink resource allocation to a base station, which may allow for uplink grants from the base station that more closely match expected uplink data (e.g., uplink data that provides a user pose or uplink scene).

[0038] In some cases, a UE may provide uplink assistance information (UAI) to a base station to assist the base station with providing uplink resources that efficiently serve an XR session. In some cases, the UAI may indicate one or more of a periodicity of uplink traffic, an offset of uplink traffic (e.g., an amount of time between a reference subframe (such as subframe 0 or system frame number 0 (SFN #0)) and a packet arrival, a data size for uplink traffic for each time period associated with the XR session, a request to enable uplink transmission skipping, or any combinations thereof. Providing such additional information may assist the base station in allocating an appropriate amount of radio resources for uplink transmission. Further, such additional information may shape the transmission pattern so that the UE may reduce its power consumption (e.g., through alignment of uplink and downlink communications that allow for the UE to transition to a sleep mode for a longer duration than for unaligned uplink and downlink communications). Further, such UAI may be helpful to the base station by allowing the network to manage radio resources efficiently in serving multiple UEs. Additionally or alternatively, the UE may provide an indication that one or more uplink communications (e.g., physical uplink shared channel (PUSCH transmissions)) are to be skipped, which may allow the base station to discontinue transmission of one or more downlink control channel transmissions (e.g., physical downlink control channel (PDCCH) transmissions) and thereby help reduce overhead in the wireless communications system.

[0039] Aspects of the subject matter described in this disclosure may be implemented to realize one or more of the following potential improvements, among others. The techniques employed by the UE may provide benefits and enhancements to the operation of the UE, base station, one or more other network components, or any combinations thereof. For example, operations performed by the UE may provide power saving improvements to the UE (e.g., through increased durations of sleep periods). In some examples, UE indication of UAI may allow for more accurate scheduling of uplink resources at the UE, which may promote higher reliability and lower latency for XR-related operations, and enhanced user experience, among other benefits. Further, UE indication of PUSCH skipping may allow a base station to discontinue associated PDCCH transmissions, and thereby allow associated resources to be allocated for other communications, allowing for enhancements in network resource usage which may further promote higher reliability, lower latency, and enhance overall network capacity.

[0040] Aspects of the disclosure are initially described in the context of wireless communications systems. Additional aspects of the disclosure are described in the context of an example communications configuration, example resource allocation schemes, and an example process flow. Aspects of the disclosure are further illustrated by and described with reference to apparatus diagrams, system diagrams, and flowcharts that relate to UE indication of uplink scheduling parameters in wireless communications.

[0041] FIG. **1** illustrates an example of a wireless communications system **100** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The wireless communications system **100** may include one or more base stations **105**, one or more UEs **115**, and a core network **130**. In some examples, the wireless communications system **100** may be a Long Term Evolution (LTE) network, an LTE-Advanced (LTE-A) network, an LTE-A Pro network, or a New Radio (NR) network. In some examples, the wireless communications system **100** may support enhanced broadband communications, ultra-reliable (e.g., mission critical) communications, low latency communications, communications

with low-cost and low-complexity devices, or any combination thereof.

[0042] The base stations **105** may be dispersed throughout a geographic area to form the wireless communications system **100** and may be devices in different forms or having different capabilities. The base stations **105** and the UEs **115** may wirelessly communicate via one or more communication links **125**. Each base station **105** may provide a coverage area **110** over which the UEs **115** and the base station **105** may establish one or more communication links **125**. The coverage area **110** may be an example of a geographic area over which a base station **105** and a UE **115** may support the communication of signals according to one or more radio access technologies.

[0043] The UEs **115** may be dispersed throughout a coverage area **110** of the wireless communications system **100**, and each UE **115** may be stationary, or mobile, or both at different times. The UEs **115** may be devices in different forms or having different capabilities. Some example UEs **115** are illustrated in FIG. **1**. The UEs **115** described herein may be able to communicate with various types of devices, such as other UEs **115**, the base stations **105**, or network equipment (e.g., core network nodes, relay devices, integrated access and backhaul (IAB) nodes, or other network equipment), as shown in FIG. **1**.

[0044] The base stations **105** may communicate with the core network **130**, or with one another, or both. For example, the base stations **105** may interface with the core network **130** through one or more backhaul links **120** (e.g., via an S1, N2, N3, or other interface). The base stations **105** may communicate with one another over the backhaul links **120** (e.g., via an X2, Xn, or other interface) either directly (e.g., directly between base stations **105**), or indirectly (e.g., via core network **130**), or both. In some examples, the backhaul links **120** may be or include one or more wireless links. One or more of the base stations **105** described herein may include or may be referred to by a person having ordinary skill in the art as a base transceiver station, a radio base station, an access point, a radio transceiver, a NodeB, an eNodeB (eNB), a next-generation NodeB or a giga-NodeB (either of which may be referred to as a gNB), a Home NodeB, a Home eNodeB, or other suitable terminology.

[0045] A UE **115** may include or may be referred to as a mobile device, a wireless device, a remote device, a handheld device, or a subscriber device, or some other suitable terminology, where the "device" may also be referred to as a unit, a station, a terminal, or a client, among other examples. A UE **115** may also include or may be referred to as a personal electronic device such as a cellular phone, a personal digital assistant (PDA), a multimedia/entertainment device (e.g., a radio, a MP3 player, or a video device), a camera, a gaming device, a navigation/positioning device (e.g., GNSS (global navigation satellite system) devices based on, for example, GPS (global positioning system), Beidou, GLONASS, or Galileo, or a terrestrial-based device), a tablet computer, a laptop computer, a netbook, a smartbook, a personal computer, a smart device, a wearable device (e.g., a smart watch, smart clothing, smart glasses, virtual reality goggles, a smart wristband, smart jewelry (e.g., a smart ring, a smart bracelet)), a drone, a robot/robotic device, a vehicle, a vehicular device, a meter (e.g., parking meter, electric meter, gas meter, water meter), a monitor, a gas pump, an appliance (e.g., kitchen appliance, washing machine, dryer), a location tag, a medical/healthcare device, an implant, a sensor/actuator, a display, or any other suitable device configured to communicate via a wireless or wired medium. In some examples, a UE **115** may also refer to a wireless local loop (WLL) station, an Internet of Things (IoT) device, an Internet of Everything (IoE) device, or an MTC device, or the like, which may be implemented in various articles such as appliances, drones, robots, vehicles, meters, among other examples. The UEs **115** described herein may be able to communicate with various types of devices, such as other UEs **115** that may sometimes act as relays as well as the base stations **105** and the network equipment including macro eNBs or gNBs, small cell eNBs or gNBs, or relay base stations, among other examples, as shown in FIG. **1**.

[0046] The UEs **115** and the base stations **105** may wirelessly communicate with one another via one or more communication links **125** over one or more carriers. The term "carrier" may refer to a

set of radio frequency spectrum resources having a defined physical layer structure for supporting the communication links **125**. For example, a carrier used for a communication link **125** may include a portion of a radio frequency spectrum band (e.g., a bandwidth part (BWP)) that is operated according to one or more physical layer channels for a given radio access technology (e.g., LTE, LTE-A, LTE-A Pro, NR). Each physical layer channel may carry acquisition signaling (e.g., synchronization signals, system information), control signaling that coordinates operation for the carrier, user data, or other signaling. The wireless communications system **100** may support communication with a UE **115** using carrier aggregation or multi-carrier operation. A UE **115** may be configured with multiple downlink component carriers and one or more uplink component carriers according to a carrier aggregation configuration. Carrier aggregation may be used with both frequency division duplexing (FDD) and time division duplexing (TDD) component carriers.

[0047] In some examples (e.g., in a carrier aggregation configuration), a carrier may also have acquisition signaling or control signaling that coordinates operations for other carriers. A carrier may be associated with a frequency channel (e.g., an evolved universal mobile telecommunication system terrestrial radio access (E-UTRA) absolute radio frequency channel number (EARFCN)) and may be positioned according to a channel raster for discovery by the UEs **115**. A carrier may be operated in a standalone mode where initial acquisition and connection may be conducted by the UEs **115** via the carrier, or the carrier may be operated in a non-standalone mode where a connection is anchored using a different carrier (e.g., of the same or a different radio access technology).

[0048] The communication links **125** shown in the wireless communications system **100** may include uplink transmissions from a UE **115** to a base station **105**, or downlink transmissions from a base station **105** to a UE **115**. Carriers may carry downlink or uplink communications (e.g., in an FDD mode) or may be configured to carry downlink and uplink communications (e.g., in a TDD mode). A carrier may be associated with a particular bandwidth of the radio frequency spectrum, and in some examples the carrier bandwidth may be referred to as a "system bandwidth" of the carrier or the wireless communications system **100**. For example, the carrier bandwidth may be one of a number of determined bandwidths for carriers of a particular radio access technology (e.g., 1.4, 3, 5, 10, 15, 20, 40, or 80 megahertz (MHz)). Devices of the wireless communications system **100** (e.g., the base stations **105**, the UEs **115**, or both) may have hardware configurations that support communications over a particular carrier bandwidth or may be configurable to support communications over one of a set of carrier bandwidths. In some examples, the wireless communications system **100** may include base stations **105** or UEs **115** that support simultaneous communications via carriers associated with multiple carrier bandwidths. In some examples, each served UE **115** may be configured for operating over portions (e.g., a sub-band, a BWP) or all of a carrier bandwidth.

[0049] Signal waveforms transmitted over a carrier may be made up of multiple subcarriers (e.g., using multi-carrier modulation (MCM) techniques such as orthogonal frequency division multiplexing (OFDM) or discrete Fourier transform spread OFDM (DFT-S-OFDM)). In a system employing MCM techniques, a resource element may consist of one symbol period (e.g., a duration of one modulation symbol) and one subcarrier, where the symbol period and subcarrier spacing are inversely related. The number of bits carried by each resource element may depend on the modulation scheme (e.g., the order of the modulation scheme, the coding rate of the modulation scheme, or both). Thus, the more resource elements that a UE **115** receives and the higher the order of the modulation scheme, the higher the data rate may be for the UE **115**. A wireless communications resource may refer to a combination of a radio frequency spectrum resource, a time resource, and a spatial resource (e.g., spatial layers or beams), and the use of multiple spatial layers may further increase the data rate or data integrity for communications with a UE **115**.

[0050] One or more numerologies for a carrier may be supported, where a numerology may include a subcarrier spacing (Δf) and a cyclic prefix. A carrier may be divided into one or more BWPs

having the same or different numerologies. In some examples, a UE **115** may be configured with multiple BWPs. In some examples, a single BWP for a carrier may be active at a given time and communications for the UE **115** may be restricted to one or more active BWPs. The time intervals for the base stations **105** or the UEs **115** may be expressed in multiples of a basic time unit which may, for example, refer to a sampling period of $T_s = 1/(\Delta f_{max} \cdot N_f)$ seconds, where Δf_{max} may represent the maximum supported subcarrier spacing, and N_f may represent the maximum supported discrete Fourier transform (DFT) size. Time intervals of a communications resource may be organized according to radio frames each having a specified duration (e.g., 10 milliseconds (ms)). Each radio frame may be identified by a system frame number (SFN) (e.g., ranging from 0 to 1023).

[0051] Each frame may include multiple consecutively numbered subframes or slots, and each subframe or slot may have the same duration. In some examples, a frame may be divided (e.g., in the time domain) into subframes, and each subframe may be further divided into a number of slots. Alternatively, each frame may include a variable number of slots, and the number of slots may depend on subcarrier spacing. Each slot may include a number of symbol periods (e.g., depending on the length of the cyclic prefix prepended to each symbol period). In some wireless communications systems **100**, a slot may further be divided into multiple mini-slots containing one or more symbols. Excluding the cyclic prefix, each symbol period may contain one or more (e.g., N_f) sampling periods. The duration of a symbol period may depend on the subcarrier spacing or frequency band of operation. A subframe, a slot, a mini-slot, or a symbol may be the smallest scheduling unit (e.g., in the time domain) of the wireless communications system **100** and may be referred to as a transmission time interval (TTI). In some examples, the TTI duration (e.g., the number of symbol periods in a TTI) may be variable. Additionally or alternatively, the smallest scheduling unit of the wireless communications system **100** may be dynamically selected (e.g., in bursts of shortened TTIs (STTIs)).

[0052] Physical channels may be multiplexed on a carrier according to various techniques. A physical control channel and a physical data channel may be multiplexed on a downlink carrier, for example, using one or more of time division multiplexing (TDM) techniques, frequency division multiplexing (FDM) techniques, or hybrid TDM-FDM techniques. A control region (e.g., a control resource set (CORESET)) for a physical control channel may be defined by a number of symbol periods and may extend across the system bandwidth or a subset of the system bandwidth of the carrier. One or more control regions (e.g., CORESETs) may be configured for a set of the UEs **115**. For example, one or more of the UEs **115** may monitor or search control regions for control information according to one or more search space sets, and each search space set may include one or multiple control channel candidates in one or more aggregation levels arranged in a cascaded manner. An aggregation level for a control channel candidate may refer to a number of control channel resources (e.g., control channel elements (CCEs)) associated with encoded information for a control information format having a given payload size. Search space sets may include common search space sets configured for sending control information to multiple UEs **115** and UE-specific search space sets for sending control information to a specific UE **115**.

[0053] Each base station **105** may provide communication coverage via one or more cells, for example a macro cell, a small cell, a hot spot, or other types of cells, or any combination thereof. The term "cell" may refer to a logical communication entity used for communication with a base station **105** (e.g., over a carrier) and may be associated with an identifier for distinguishing neighboring cells (e.g., a physical cell identifier (PCID), a virtual cell identifier (VCID), or others). In some examples, a cell may also refer to a geographic coverage area **110** or a portion of a geographic coverage area **110** (e.g., a sector) over which the logical communication entity operates. Such cells may range from smaller areas (e.g., a structure, a subset of structure) to larger areas depending on various factors such as the capabilities of the base station **105**. For example, a cell may be or include a building, a subset of a building, or exterior spaces between or overlapping with

geographic coverage areas **110**, among other examples.

[0054] A macro cell covers a relatively large geographic area (e.g., several kilometers in radius) and may allow unrestricted access by the UEs **115** with service subscriptions with the network provider supporting the macro cell. A small cell may be associated with a lower-powered base station **105**, as compared with a macro cell, and a small cell may operate in the same or different (e.g., licensed, unlicensed) frequency bands as macro cells. Small cells may provide unrestricted access to the UEs **115** with service subscriptions with the network provider or may provide restricted access to the UEs **115** having an association with the small cell (e.g., the UEs **115** in a closed subscriber group (CSG), the UEs **115** associated with users in a home or office). A base station **105** may support one or multiple cells and may also support communications over the one or more cells using one or multiple component carriers. In some examples, a carrier may support multiple cells, and different cells may be configured according to different protocol types (e.g., MTC, narrowband IoT (NB-IoT), enhanced mobile broadband (eMBB)) that may provide access for different types of devices.

[0055] A base station **105** may be movable and therefore provide communication coverage for a moving geographic coverage area **110**. In some examples, different geographic coverage areas **110** associated with different technologies may overlap, but the different geographic coverage areas **110** may be supported by the same base station **105**. In other examples, the overlapping geographic coverage areas **110** associated with different technologies may be supported by different base stations **105**. The wireless communications system **100** may include, for example, a heterogeneous network in which different types of the base stations **105** provide coverage for various geographic coverage areas **110** using the same or different radio access technologies.

[0056] The wireless communications system **100** may support synchronous or asynchronous operation. For synchronous operation, the base stations **105** may have similar frame timings, and transmissions from different base stations **105** may be approximately aligned in time. For asynchronous operation, the base stations **105** may have different frame timings, and transmissions from different base stations **105** may, in some examples, not be aligned in time. The techniques described herein may be used for either synchronous or asynchronous operations.

[0057] Some UEs **115**, such as MTC or IoT devices, may be low cost or low complexity devices and may provide for automated communication between machines (e.g., via Machine-to-Machine (M2M) communication). M2M communication or MTC may refer to data communication technologies that allow devices to communicate with one another or a base station **105** without human intervention. In some examples, M2M communication or MTC may include communications from devices that integrate sensors or meters to measure or capture information and relay such information to a central server or application program that makes use of the information or presents the information to humans interacting with the application program. Some UEs **115** may be designed to collect information or enable automated behavior of machines or other devices. Examples of applications for MTC devices include smart metering, inventory monitoring, water level monitoring, equipment monitoring, healthcare monitoring, wildlife monitoring, weather and geological event monitoring, fleet management and tracking, remote security sensing, physical access control, and transaction-based business charging. In an aspect, techniques disclosed herein may be applicable to MTC or IoT UEs. MTC or IoT UEs may include MTC/enhanced MTC (eMTC, also referred to as CAT-M, Cat M1) UEs, NB-IoT (also referred to as CAT NB1) UEs, as well as other types of UEs. cMTC and NB-IoT may refer to future technologies that may evolve from or may be based on these technologies. For example, eMTC may include FeMTC (further eMTC), eFeMTC (enhanced further eMTC), and mMTC (massive MTC), and NB-IoT may include eNB-IoT (enhanced NB-IoT), and FeNB-IoT (further enhanced NB-IoT).

[0058] Some UEs **115** may be configured to employ operating modes that reduce power consumption, such as half-duplex communications (e.g., a mode that supports one-way communication via transmission or reception, but not transmission and reception simultaneously).

In some examples, half-duplex communications may be performed at a reduced peak rate. Other power conservation techniques for the UEs **115** include entering a power saving deep sleep mode when not engaging in active communications, operating over a limited bandwidth (e.g., according to narrowband communications), or a combination of these techniques. For example, some UEs **115** may be configured for operation using a narrowband protocol type that is associated with a defined portion or range (e.g., set of subcarriers or resource blocks (RBs)) within a carrier, within a guard-band of a carrier, or outside of a carrier.

[0059] The wireless communications system **100** may be configured to support ultra-reliable communications or low-latency communications, or various combinations thereof. For example, the wireless communications system **100** may be configured to support ultra-reliable low-latency communications (URLLC) or mission critical communications. The UEs **115** may be designed to support ultra-reliable, low-latency, or critical functions (e.g., mission critical functions). Ultra-reliable communications may include private communication or group communication and may be supported by one or more mission critical services such as mission critical push-to-talk (MCPTT), mission critical video (MCVideo), or mission critical data (MCData). Support for mission critical functions may include prioritization of services, and mission critical services may be used for public safety or general commercial applications. The terms ultra-reliable, low-latency, mission critical, and ultra-reliable low-latency may be used interchangeably herein.

[0060] The base station **105** and the UE **115** may support various types of applications that may have periodic or semi-periodic data traffic. The base station **105** may be in wireless communication with a server (e.g., a server that is included in or connected with the wireless communications system **100**), which may provide the periodic or semi-periodic data traffic to the base station **105** to forward to the UE **115**. Likewise, the UE **115** may provide the periodic or semi-periodic data traffic to the base station **105** to forward to the server. The server may be a cloud server, a server associated with an application subscription provider, proxy server, web server, application server, or any combination thereof. The server may include an application distribution platform. The application distribution platform may allow the UE **115** to discover, browse, share, and download applications via the base station **105**, and therefore provide a digital distribution of the application from the application distribution platform. As such, a digital distribution may be a form of delivering content such as data, without the use of physical media but over online delivery mediums, such as the Internet. For example, the UE **115** may upload or download applications for streaming, downloading, uploading, or processing, data (e.g., images, audio, video). The server may also transmit to the UE **115** a variety of information, such as instructions or commands to download applications on the UE **115** via the base station **105**.

[0061] By way of example, the base station **105** and the UE **115** may support XR applications, which may have periodic or semi-periodic XR data traffic. An XR application may support various frame rates, for example 60 MHz frame rates or 120 MHz frame rates. The server and UE **115** may generate an XR frame at 60 MHz, which may correspond to a periodicity of 16.67 ms. Alternatively, the server and UE **115** may generate an XR frame at 120 MHz, which may correspond to a periodicity of 8.33 ms. The server may transmit the periodic or semi-periodic XR data traffic to the base station **105**, which may forward the XR data traffic to the UE **115**, and likewise the UE **115** may transmit the periodic or semi-periodic XR data traffic to the base station **105**, which may forward the XR data traffic to the server. The XR data traffic may be divided into multiple slices (also referred to as files) and each slice encoded and transmitted separately to the base station **105**, which may forward the XR data traffic using multiple TBs (also referred to as a burst of TBs).

[0062] For XR applications features from the real and virtual environments may be overlaid and displayed to a user for consumption via the UE **115**. To avoid visual conflicts, such as misaligning objects from the real and virtual environments, among other visual conflicts, the UE **115** may generate and send pose information to a network (e.g., a server hosting the XR application). The

pose information may define a position and orientation of the UE **115** (or user) in space relative to the real and virtual environments. In some cases, different applications may have different uplink data flows.

[0063] For VR applications there may be a single uplink data flow. For example, the UE **115** may generate pose information (e.g., six degree of freedom (6DOF) pose information) and other control information. In some examples, the UE **115** may generate or transmit the pose information based on a data rate (e.g., 0.5-2 Mbps). The UE **115** may transmit the pose information and other control information based on an uplink transmit periodicity (e.g., 2 mn (500 Hz)). In some examples, the pose information and other control information may have different file sizes (e.g., 0.5 Mbit/500=1 Kbit=125 byte, 2 Mbit/500=4 Kbit=500 byte). An FDP may be 1.25 ms to 10 ms.

[0064] For AR applications there may be two uplink data flows. As part of the first uplink data flow, the UE **115** may generate pose information (e.g., 6DOF pose information) and other control information. The UE **115** may generate or transmit the pose information based on a data rate (e.g., 0.5-2 Mbps). The UE **115** may transmit the pose information and other control information based on an uplink transmit periodicity (e.g., 2 mn (500 Hz)). Similarly, for the AR applications, the FDP may be 1.25 ms to 10 ms. As part of the second uplink data flow, the UE **115** may generate pose information for a scene update associated with the AR applications. For scene updates, the UE **115** may generate or transmit the pose information based on a data rate (e.g., 10 Mbps at 10 Hz). In some examples, the pose information may have different file sizes (e.g., 1 Mbits per 100 ms=125 kbyte). An FDB may be 100 ms.

[0065] The UE **115** may benefit from the periodic or semi-periodic data traffic, and more specifically from the transmission delay between bursts of TBs carrying the periodic or semi-periodic data traffic to implement various operations to reduce power consumption. The UE **115** may send the pose information and/or other control information in accordance with a configured grant, a dynamic grant, or a proactive grant, which, in some cases, may configure the UE **115** with a set of parameters to use when transmitting the pose information and/or other control information to the network. Various aspects of the present disclosure relate to UE **115** transmission of uplink scheduling information, such as UAI or a PUSCH skipping indication, which may allow for efficient uplink resource allocation for the UE **115**. Thus, the UE **115** may provide scheduling information based on uplink traffic parameters, which may result in improved reliability and latency for XR applications, and reduced power consumption for the UE **115**.

[0066] In some examples, a UE **115** may also be able to communicate directly with other UEs **115** over a device-to-device (D2D) communication link **135** (e.g., using a peer-to-peer (P2P) or D2D protocol). One or more UEs **115** utilizing D2D communications may be within the geographic coverage area **110** of a base station **105**. Other UEs **115** in such a group may be outside the geographic coverage area **110** of a base station **105** or be otherwise unable to receive transmissions from a base station **105**. In some examples, groups of the UEs **115** communicating via D2D communications may utilize a one-to-many (1:M) system in which each UE **115** transmits to every other UE **115** in the group. In some examples, a base station **105** facilitates the scheduling of resources for D2D communications. In other cases, D2D communications are carried out between the UEs **115** without the involvement of a base station **105**.

[0067] In some systems, the D2D communication link **135** may be an example of a communication channel, such as a sidelink communication channel, between vehicles (e.g., UEs **115**). In some examples, vehicles may communicate using vehicle-to-everything (V2X) communications, vehicle-to-vehicle (V2V) communications, or some combination of these. A vehicle may signal information related to traffic conditions, signal scheduling, weather, safety, emergencies, or any other information relevant to a V2X system. In some examples, vehicles in a V2X system may communicate with roadside infrastructure, such as roadside units, or with the network via one or more network nodes (e.g., base stations **105**) using vehicle-to-network (V2N) communications, or with both.

[0068] The core network **130** may provide user authentication, access authorization, tracking, Internet Protocol (IP) connectivity, and other access, routing, or mobility functions. The core network **130** may be an evolved packet core (EPC) or 5G core (5GC), which may include at least one control plane entity that manages access and mobility (e.g., a mobility management entity (MME), an access and mobility management function (AMF)) and at least one user plane entity that routes packets or interconnects to external networks (e.g., a serving gateway (S-GW), a Packet Data Network (PDN) gateway (P-GW), or a user plane function (UPF)). The control plane entity may manage non-access stratum (NAS) functions such as mobility, authentication, and bearer management for the UEs **115** served by the base stations **105** associated with the core network **130**. User IP packets may be transferred through the user plane entity, which may provide IP address allocation as well as other functions. The user plane entity may be connected to IP services **150** for one or more network operators. The IP services **150** may include access to the Internet, Intranet(s), an IP Multimedia Subsystem (IMS), or a Packet-Switched Streaming Service.

[0069] Some of the network devices, such as a base station **105**, may include subcomponents such as an access network entity **140**, which may be an example of an access node controller (ANC). Each access network entity **140** may communicate with the UEs **115** through one or more other access network transmission entities **145**, which may be referred to as radio heads, smart radio heads, or transmission/reception points (TRPs). Each access network transmission entity **145** may include one or more antenna panels. In some configurations, various functions of each access network entity **140** or base station **105** may be distributed across various network devices (e.g., radio heads and ANCs) or consolidated into a single network device (e.g., a base station **105**).

[0070] The wireless communications system **100** may operate using one or more frequency bands, in the range of 300 megahertz (MHz) to 300 gigahertz (GHz). The region from 300 MHz to 3 GHz is known as the ultra-high frequency (UHF) region or decimeter band because the wavelengths range from approximately one decimeter to one meter in length. The UHF waves may be blocked or redirected by buildings and environmental features, but the waves may penetrate structures sufficiently for a macro cell to provide service to the UEs **115** located indoors. The transmission of UHF waves may be associated with smaller antennas and shorter ranges (e.g., less than 100 kilometers) compared to transmission using the smaller frequencies and longer waves of the high frequency (HF) or very high frequency (VHF) portion of the spectrum below 300 MHZ.

[0071] The wireless communications system **100** may also operate in a super high frequency (SHF) region using frequency bands from 3 GHz to 30 GHz, also known as the centimeter band, or in an extremely high frequency (EHF) region of the spectrum (e.g., from 30 GHz to 300 GHz), also known as the millimeter band. In some examples, the wireless communications system **100** may support millimeter wave (mmW) communications between the UEs **115** and the base stations **105**, and EHF antennas of the respective devices may be smaller and more closely spaced than UHF antennas. In some examples, this may facilitate use of antenna arrays within a device. The propagation of EHF transmissions, however, may be subject to even greater atmospheric attenuation and shorter range than SHF or UHF transmissions. The techniques disclosed herein may be employed across transmissions that use one or more different frequency regions, and designated use of bands across these frequency regions may differ by country or regulating body.

[0072] The wireless communications system **100** may utilize both licensed and unlicensed radio frequency spectrum bands. For example, the wireless communications system **100** may employ License Assisted Access (LAA), LTE-Unlicensed (LTE-U) radio access technology, or NR technology in an unlicensed band such as the 5 GHz industrial, scientific, and medical (ISM) band. When operating in unlicensed radio frequency spectrum bands, devices such as the base stations **105** and the UEs **115** may employ carrier sensing for collision detection and avoidance. In some examples, operations in unlicensed bands may be based on a carrier aggregation configuration in conjunction with component carriers operating in a licensed band (e.g., LAA). Operations in unlicensed spectrum may include downlink transmissions, uplink transmissions, P2P transmissions,

or D2D transmissions, among other examples.

[0073] A base station **105** or a UE **115** may be equipped with multiple antennas, which may be used to employ techniques such as transmit diversity, receive diversity, multiple-input multiple-output (MIMO) communications, or beamforming. The antennas of a base station **105** or a UE **115** may be located within one or more antenna arrays or antenna panels, which may support MIMO operations or transmit or receive beamforming. For example, one or more base station antennas or antenna arrays may be co-located at an antenna assembly, such as an antenna tower. In some examples, antennas or antenna arrays associated with a base station **105** may be located in diverse geographic locations. A base station **105** may have an antenna array with a number of rows and columns of antenna ports that the base station **105** may use to support beamforming of communications with a UE **115**. Likewise, a UE **115** may have one or more antenna arrays that may support various MIMO or beamforming operations. Additionally or alternatively, an antenna panel may support radio frequency beamforming for a signal transmitted via an antenna port.

[0074] The base stations **105** or the UEs **115** may use MIMO communications to exploit multipath signal propagation and increase the spectral efficiency by transmitting or receiving multiple signals via different spatial layers. Such techniques may be referred to as spatial multiplexing. The multiple signals may, for example, be transmitted by the transmitting device via different antennas or different combinations of antennas. Likewise, the multiple signals may be received by the receiving device via different antennas or different combinations of antennas. Each of the multiple signals may be referred to as a separate spatial stream and may carry bits associated with the same data stream (e.g., the same codeword) or different data streams (e.g., different codewords). Different spatial layers may be associated with different antenna ports used for channel measurement and reporting. MIMO techniques include single-user MIMO (SU-MIMO), where multiple spatial layers are transmitted to the same receiving device, and multiple-user MIMO (MU-MIMO), where multiple spatial layers are transmitted to multiple devices.

[0075] Beamforming, which may also be referred to as spatial filtering, directional transmission, or directional reception, is a signal processing technique that may be used at a transmitting device or a receiving device (e.g., a base station **105**, a UE **115**) to shape or steer an antenna beam (e.g., a transmit beam, a receive beam) along a spatial path between the transmitting device and the receiving device. Beamforming may be achieved by combining the signals communicated via antenna elements of an antenna array such that some signals propagating at particular orientations with respect to an antenna array experience constructive interference while others experience destructive interference. The adjustment of signals communicated via the antenna elements may include a transmitting device or a receiving device applying amplitude offsets, phase offsets, or both to signals carried via the antenna elements associated with the device. The adjustments associated with each of the antenna elements may be defined by a beamforming weight set associated with a particular orientation (e.g., with respect to the antenna array of the transmitting device or receiving device, or with respect to some other orientation).

[0076] A base station **105** or a UE **115** may use beam sweeping techniques as part of beam forming operations. For example, a base station **105** may use multiple antennas or antenna arrays (e.g., antenna panels) to conduct beamforming operations for directional communications with a UE **115**. Some signals (e.g., synchronization signals, reference signals, beam selection signals, or other control signals) may be transmitted by a base station **105** multiple times in different directions. For example, the base station **105** may transmit a signal according to different beamforming weight sets associated with different directions of transmission. Transmissions in different beam directions may be used to identify (e.g., by a transmitting device, such as a base station **105**, or by a receiving device, such as a UE **115**) a beam direction for later transmission or reception by the base station **105**.

[0077] Some signals, such as data signals associated with a particular receiving device, may be transmitted by a base station **105** in a single beam direction (e.g., a direction associated with the

receiving device, such as a UE **115**). In some examples, the beam direction associated with transmissions along a single beam direction may be determined based on a signal that was transmitted in one or more beam directions. For example, a UE **115** may receive one or more of the signals transmitted by the base station **105** in different directions and may report to the base station **105** an indication of the signal that the UE **115** received with a highest signal quality or an otherwise acceptable signal quality.

[0078] In some examples, transmissions by a device (e.g., by a base station **105** or a UE **115**) may be performed using multiple beam directions, and the device may use a combination of digital precoding or radio frequency beamforming to generate a combined beam for transmission (e.g., from a base station **105** to a UE **115**). The UE **115** may report feedback that indicates precoding weights for one or more beam directions, and the feedback may correspond to a configured number of beams across a system bandwidth or one or more sub-bands. The base station **105** may transmit a reference signal (e.g., a cell-specific reference signal (CRS), a channel state information reference signal (CSI-RS)), which may be precoded or unprecoded. The UE **115** may provide feedback for beam selection, which may be a precoding matrix indicator (PMI) or codebook-based feedback (e.g., a multi-panel type codebook, a linear combination type codebook, a port selection type codebook). Although these techniques are described with reference to signals transmitted in one or more directions by a base station **105**, a UE **115** may employ similar techniques for transmitting signals multiple times in different directions (e.g., for identifying a beam direction for subsequent transmission or reception by the UE **115**) or for transmitting a signal in a single direction (e.g., for transmitting data to a receiving device).

[0079] A receiving device (e.g., a UE **115**) may try multiple receive configurations (e.g., directional listening) when receiving various signals from the base station **105**, such as synchronization signals, reference signals, beam selection signals, or other control signals. For example, a receiving device may try multiple receive directions by receiving via different antenna subarrays, by processing received signals according to different antenna subarrays, by receiving according to different receive beamforming weight sets (e.g., different directional listening weight sets) applied to signals received at multiple antenna elements of an antenna array, or by processing received signals according to different receive beamforming weight sets applied to signals received at multiple antenna elements of an antenna array, any of which may be referred to as "listening" according to different receive configurations or receive directions. In some examples, a receiving device may use a single receive configuration to receive along a single beam direction (e.g., when receiving a data signal). The single receive configuration may be aligned in a beam direction determined based on listening according to different receive configuration directions (e.g., a beam direction determined to have a highest signal strength, highest signal-to-noise ratio (SNR), or otherwise acceptable signal quality based on listening according to multiple beam directions).

[0080] The wireless communications system **100** may be a packet-based network that operates according to a layered protocol stack. In the user plane, communications at the bearer or Packet Data Convergence Protocol (PDCP) layer may be IP-based. A Radio Link Control (RLC) layer may perform packet segmentation and reassembly to communicate over logical channels. A Medium Access Control (MAC) layer may perform priority handling and multiplexing of logical channels into transport channels. The MAC layer may also use error detection techniques, error correction techniques, or both to support retransmissions at the MAC layer to improve link efficiency. In the control plane, the Radio Resource Control (RRC) protocol layer may provide establishment, configuration, and maintenance of an RRC connection between a UE **115** and a base station **105** or a core network **130** supporting radio bearers for user plane data. At the physical layer, transport channels may be mapped to physical channels.

[0081] In some cases, information transmitted by a UE **115** may have a traffic pattern that is based on periodic XR data flows. In some cases, a UE **115** may provide one or more scheduling parameters to a base station **105** to assist the base station **105** with resource allocation for uplink

communications associated with an XR session (or other communications session having a periodic uplink traffic flow). In some cases, a UE **115** may provide UAI to a base station **105** to assist the base station **105** with providing uplink resources that efficiently serve an XR session. In some cases, the UAI may indicate one or more of a periodicity of uplink traffic, an offset between uplink traffic and a packet arrival, a data size for uplink traffic for each time period associated with the XR session, a request to enable uplink transmission skipping, or any combinations thereof.

[0082] FIG. **2** illustrates an example of a wireless communications system **200** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. In some examples, wireless communications system **200** may implement aspects of wireless communications system **100**. The wireless communications system **200** may include a UE **115**-*a*, a base station **105**-*a*, which may be examples of UEs **115** and base stations **105**, as described with reference to FIG. **1**, and an XR server **205**.

[0083] The UE **115**-*a* may communicate with the base station **105**-*a* using a communication link **210**-*a*. In some cases, the communication link **210**-*a* may include an example of an access link (e.g., a Uu link). The communication link **210**-*a* may include a bi-directional link that can include both uplink and downlink communication. For example, the UE **115**-*a* may transmit uplink transmissions, such as uplink control signals or uplink data signals (e.g., uplink scheduling information **215** and uplink transmissions **230**), to the base station **105**-*a* using the communication link **210**-*a*. The base station **105**-*a* may transmit downlink transmissions, such as RRC messages **220**, uplink grants **225**, other downlink control information (DCI), downlink data signals (e.g., PDSCH transmissions), or combinations thereof, to the UE **115**-*a* using the communication link **210**-*a*.

[0084] Similarly, the base station **105**-*a* may communicate with the XR server **205** using a communication link **210**-*b*. Moreover, the UE **115**-*a* may communicate with the XR server **205** through the base station **105**-*a* (e.g., via communication links **210**-*a* and **210**-*b*). For example, the UE **115**-*a* may transmit uplink transmissions **230** to the base station **105**-*a* via the communication link **210**-*a*, where the base station **105**-*a* may relay or forward the uplink transmissions **230** to the XR server **205** for processing. The communication links **210**-*a* and **210**-*b* may include unidirectional communication links and/or bidirectional communications links. In the context of an XR application, the UE **115**-*a* may transmit uplink data associated with the XR application (e.g., pose information, control information, scene information) to the XR server **205** via communication links **210**-*a* and **210**-*b*. The XR server **205** may then encode and render XR frames based on the received information, and may transmit XR frames to the base station **105**-*a* via communication link **210**-*b*. Subsequently, the base station **105**-*a* may transmit downlink data (e.g., XR frames, XR frame bursts) to the UE **115**-*a* via communication link **210**-*a*.

[0085] As discussed herein, the UE **115**-*a* may in some cases, transmit uplink scheduling information **215** to the base station **105**-*a* that may allow for efficient allocation of uplink resources. The uplink scheduling information **215** may include, for example, UAI related to an uplink traffic pattern for an XR session, an indication of PUSCH skipping, or any combinations thereof. In some cases, the UAI may indicate one or more of a periodicity of uplink traffic, an offset between uplink traffic and a packet arrival, a data size for uplink traffic for each time period associated with the XR session, a request to enable uplink transmission skipping, or any combinations thereof. Based on the uplink scheduling information, the base station **105**-*a* may allocate uplink resources, which may be indicated to the UE **115**-*a* in RRC message **220** (e.g., for a configured grant), or in DCI that contains one or more uplink grants **225**. Based on the resource allocation received from the base station **105**-*a*, the UE **115**-*a* may transmit uplink transmissions **230** in accordance with the allocation uplink resources. Such techniques may allow for efficient wireless resource utilization through efficient allocations of uplink resources and reallocation of wireless resources in the event that the UE **115**-*a* indicates PUSCH skipping. Further, such techniques may allow for additional power savings at the UE **115**-*a* through alignment of uplink

and downlink communications and allowing the UE **115**-*a* to enter a sleep mode between communication bursts.

[0086] FIGS. **3**A and **3**B illustrate example of transmission configurations **300** that support UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. In some examples, transmission configurations **300** may implement aspects of wireless communications systems **100** or **200**. For example, the transmission configuration **300**-*a* may be based on a configuration by a base station **105** and implemented by a UE **115**. In the example of FIG. **3**A, the base station may transmit, and the UE may receive, a dynamic grants for downlink receptions **305**-*a* and uplink transmissions **310**-*a*. For example, the base station may transmit, and the UE may receive, a grant via DCI from the base station.

[0087] In some cases, such as illustrated in FIG. **3**A, the downlink receptions **305**-*a* and the uplink transmissions **310**-*a* may not be aligned, and thus the UE awake time is extended which thereby results in a period of increased UE power consumption **315**-*a* that is longer than a duration that would be needed if downlink reception **305**-*a* and uplink transmission **310**-*a* were aligned. In accordance with various aspects of the present disclosure, UE indication of scheduling information to the base station may allow the base station to allocate aligned resources to the UE, such as illustrated in FIG. **3**B. In the example of FIG. **3**B, the base station in allocation **300**-*b* may allocate resources for downlink reception **305**-*b* and uplink transmission **310**-*b* that are more closely aligned. Such alignment allows for a reduced period of UE power consumption **315**-*b*, and may allow the UE to transition to a power-saving or sleep mode between communication bursts.

[0088] FIG. **4** illustrates an example of a downlink control channel and uplink shared channel communications **400** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. In this example, a UE and base station (e.g., a base station **105** and UE **115** as discussed herein) may communicate periodic traffic associated with an XR application.

[0089] In this example, an XR data traffic arrival **405** may occur in a time offset **410** between a reference time (e.g., subframe 0 or SFN-0) and an initial PDCCH **415**-*a* that starts an uplink burst. The initial PDCCH **415**-*a* may provide an uplink grant for a first PUSCH **420**-*a*, followed by a second PDCCH **415**-*b*, a second PUSCH **420**-*b*, and a third PDCCH **415**-*c*. In this example, an amount of uplink traffic at the UE may result in the UE not needing the third PUSCH resources, and the UE may skip the third PUSCH as indicated as skip **425**-*a*. In this example, the XR data may have a periodicity **430** such that a subsequent burst will start according to the period of periodicity **430**. The UE may transition to a low power sleep **435**-*a* between bursts, and may transition back to an awake mode for a fourth PDCCH **415**-*d*, a fourth PUSCH **420**-*c*, a fifth PDCCH **415**-*c*, a fifth PUSCH **420**-*d*, and a sixth PDCCH **415**-*f*. Again, based on an amount of traffic of the XR traffic pattern, the PUSCH associated with the sixth PDCCH **415**-*f* may be skipped, as indicated as skip **425**-*b*, and the UE may transition again to low power sleep **435**-*b*.

[0090] In some cases, the UE may identify one or more parameters associated with the XR traffic, which may be provided to the base station to assist with uplink scheduling. In some cases, the UE may transmit UAI that can request and provide additional information to the base station about uplink pose/control information timing, which is favorable for power saving, which the base station can use in uplink scheduling. In some cases, the UAI may include a number of parameters that provide additional information to help uplink scheduling at the base station, such as a preferred periodicity of uplink grants, a preferred time offset of uplink grants, an average data size per period, a request for enabling of PUSCH skipping (e.g., a request that indicates skipUplinkTxDymaic=TRUE). Using such UAI, the base station or other scheduler at the network can configure a scheduling pattern or modify an existing scheduling pattern. Such a scheduling pattern may allow for efficient scheduling of wireless resources based on an expected XR traffic pattern, and may also provide the benefit of additional UE power saving through alignment of downlink and uplink communications.

[0091] In some cases, when an XR session starts, the UE can request uplink scheduling by sending the UAI to the serving base station (e.g., in uplink control information (UCI), in RRC signaling (e.g., in an information element for UAI), in a MAC-CE, or any combinations thereof. The base station, upon receipt of the UAI, may optionally configure or modify an uplink scheduling configuration for periodic uplink bursts in accordance with the UAI. The uplink scheduling configuration may include one or more of a configured grant, enablement of PUSCH skipping, sounding reference signal transmission configuration, channel state information (CSI) report configuration, discontinuous reception (DRX) configuration, or any combinations thereof. The timing of uplink scheduling may be determined based on preference parameters carried in UAI. In some cases, if the base station configures skipUplinkTxDymaic set to true in a separate RRC message, then UE can skip PUSCH for a dynamic grant. In some cases, the UE may provide an indication that it will skip one or more PUSCH transmissions, which may allow the base station to discontinue transmitting DCI in some situations, such as discussed with reference to FIG. **5**.

[0092] FIG. **5** illustrates an example of a downlink control channel and uplink shared channel **500** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. In this example, a UE and base station (e.g., a base station **105** and UE **115** as discussed herein) may communicate periodic traffic associated with an XR application.

[0093] In this example, an XR data traffic arrival **505** may occur in a time offset **510** between a reference time (e.g., subframe 0 or SFN-0) and an initial PDCCH **515**-*a* that starts an uplink burst, where uplink bursts have periodicity **530**. The initial PDCCH **515**-*a* may provide an uplink grant for a first PUSCH **520**-*a*, followed by a second PDCCH **515**-*b* and a third PDCCH **515**-*c* that provide subsequent uplink grants. In this example, an amount of uplink traffic at the UE may result in the UE not needing the second and third PUSCH resources, and the UE may skip these PUSCHs as indicated as skip **525**-*a* and skip **525**-*b*. In such cases, the second PDCCH **515**-*b* and the third PDCCH **515**-*c* are each wasted, as the allocated resources are unused. In accordance with various aspects of the present disclosure, the UE may transmit an indication **535** that indicates one or more subsequent PUSCHs are to be skipped. In the example of FIG. **5**, a fourth PDCCH **515**-*d* may provide an allocation for a second PUSCH **520**-*b*, and subsequent to the second PUSCH **520**-*b* (e.g., in UCI that is provided with or separate from the PUSCH), the UE may provide the indication **535** that indicates PUSCH skipping. Based on the indication **535**, the base station may discontinue PDCCH transmissions, such that no more PDCCH are provided to the UE for a certain duration, as indicated at **540**.

[0094] Such techniques may allow the base station to reduce PDCCH overhead, and reallocate such resources for other communications. In some cases, the PDCCHs **515** may be proactive grants, that are transmitted through regular DCI. If the UE skips the indicated uplink transmissions, the base station may stop sending uplink grants based on the indication **535**, which may provide an explicit indication of PUSCH skipping. In the absence of the explicit indication **535**, it may be ambiguous at the base station as to whether the PUSCH was skipped or whether there was a decoding error. In some cases, the time period for discontinuing PDCCH transmissions and sending additional uplink grants may be for a predetermined time period, for a time period provided with system information (e.g., in RRC signaling or a remaining minimum system information (RMSI) communication), or until a specific time (e.g., start of next XR traffic burst). In some cases, the indication **535** may be provided in a SR, such as in a multi-bit SR in which one SR state may be assigned for this purpose. In other cases, the indication **535** may be provided in a MAC-CE with BSR=0. In other cases, the indication **535** may be provided in UCI (e.g., a layer-1 (L1) communication) or MAC-CE that sets an inactivity timer to zero and thus triggers the UE to enter a DRX OFF state with no further PDCCH. In other cases, the indication **525** may be provided in a UCI (e.g., L1) request to skip PDCCH monitoring, that may indicate that the UE may be still in an active state but with no PDCCH monitoring.

[0095] FIG. **6** illustrates an example of a process flow **600** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. In some examples, process flow **600** may implement aspects of wireless communications system **100** and the wireless communications system **200** described with reference to FIGS. **1** and **2**, respectively. The process flow **600** may be based on a configuration by a base station **105**-*b* and implemented by a UE **115**-*b* to promote power saving for the UE **115**-*b* by alignment of uplink and downlink communications, and to promote efficient resource usage through efficient and accurate scheduling of communications resources for an XR flow. The process flow **600** may be implemented to promote high reliability and low latency communications (e.g., transmission of position information and control information of the UE **115**-*b* for an XR application), among other benefits.

[0096] In the following description of the process flow **600**, the operations between the base station **105**-*b* and the UE **115**-*b* may be transmitted in a different order than the example order shown, or the operations performed by the base station **105**-*b* and the UE **115**-*b* may be performed in different orders or at different times. Some operations may also be omitted from the process flow **600**, and other operations may be added to the process flow **600**. The base station **105**-*b* and the UE **115**-*b* may be examples of a base station **105** and a UE **115** as described herein.

[0097] At **605**, the base station **105**-*b* and the UE **115**-*b* may initiate an XR session. In some cases, the XR session may be initiated based on the UE **115**-*b* entering into communications to exchange XR traffic with an XR server via communications through the base station **105**-*b*. At **610**, the UE **115**-*b* may obtain uplink traffic information. In some cases, the uplink traffic information may be based on pose/control information and periodicity for an XR traffic flow.

[0098] At **615**, the UE **115**-*b* may transmit UAI for uplink scheduling. The UAI may include one or more uplink scheduling parameters, as discussed herein. At **620**, the base station **105**-*b* may determine a scheduling configuration for the UE **115**-*b*. The scheduling configuration may include a set of periodic uplink grants and a set of periodic downlink grants that are identified based at least in part on the UAI. Optionally, at **625**, the base station **105**-*b* may transmit a RRC message for random access. At **630**, the base station **105**-*b* may allocate uplink grant resources to the UE **115**-*b*. A number of instance of uplink grants may be provided to the UE **115**-*b* at **635**-*a*, **635**-*b*, and **635**-*c*, and a number of instances of PUSCH transmissions may be transmitted by the UE **115**-*b* at **640**-*a*, **640**-*b*, and **640**-*c*, in accordance with techniques as discussed herein.

[0099] Optionally, at **645**, the UE **115**-*b* may determine that uplink skipping is to be used. For example, the UE **115**-*b* may determine that uplink data is not to be transmitted in a PUSCH, such as due to an empty uplink buffer. At **650**, in such cases, the UE **115**-*b* may transmit an uplink skipping indication. At **655**, the base station **105**-*b* may receive the uplink skipping indication, and determine to discontinue providing uplink grants and associated PDCCH transmissions for a certain duration. The period of the certain duration may be a predetermined period or may correspond to a period until a next uplink burst, as discussed herein.

[0100] FIG. **7** shows a block diagram **700** of a device **705** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The device **705** may be an example of aspects of a UE **115** as described herein. The device **705** may include a receiver **710**, a transmitter **715**, and a communications manager **720**. The device **705** may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

[0101] The receiver **710** may provide a means for receiving information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE indication of uplink scheduling parameters in wireless communications). Information may be passed on to other components of the device **705**. The receiver **710** may utilize a single antenna or a set of multiple antennas.

[0102] The transmitter **715** may provide a means for transmitting signals generated by other

components of the device **705**. For example, the transmitter **715** may transmit information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE indication of uplink scheduling parameters in wireless communications). In some examples, the transmitter **715** may be co-located with a receiver **710** in a transceiver module. The transmitter **715** may utilize a single antenna or a set of multiple antennas.

[0103] The communications manager **720**, the receiver **710**, the transmitter **715**, or various combinations thereof or various components thereof may be examples of means for performing various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein. For example, the communications manager **720**, the receiver **710**, the transmitter **715**, or various combinations or components thereof may support a method for performing one or more of the functions described herein.

[0104] In some examples, the communications manager **720**, the receiver **710**, the transmitter **715**, or various combinations or components thereof may be implemented in hardware (e.g., in communications management circuitry). The hardware may include a processor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA) or other programmable logic device, a discrete gate or transistor logic, discrete hardware components, or any combination thereof configured as or otherwise supporting a means for performing the functions described in the present disclosure. In some examples, a processor and memory coupled with the at least one processor may be configured to perform one or more of the functions described herein (e.g., by executing, by the processor, instructions stored in the memory).

[0105] Additionally or alternatively, in some examples, the communications manager **720**, the receiver **710**, the transmitter **715**, or various combinations or components thereof may be implemented in code (e.g., as communications management software) executed by a processor. If implemented in code executed by a processor, the functions of the communications manager **720**, the receiver **710**, the transmitter **715**, or various combinations or components thereof may be performed by a general-purpose processor, a DSP, a central processing unit (CPU), a graphics processing unit (GPU), an ASIC, an FPGA, or any combination of these or other programmable logic devices (e.g., configured as or otherwise supporting a means for performing the functions described in the present disclosure).

[0106] In some examples, the communications manager **720** may be configured to perform various operations (e.g., receiving, monitoring, transmitting) using or otherwise in cooperation with the receiver **710**, the transmitter **715**, or both. For example, the communications manager **720** may receive information from the receiver **710**, send information to the transmitter **715**, or be integrated in combination with the receiver **710**, the transmitter **715**, or both to receive information, transmit information, or perform various other operations as described herein.

[0107] The communications manager **720** may support wireless communication at a UE in accordance with examples as disclosed herein. For example, the communications manager **720** may be configured as or otherwise support a means for transmitting, responsive to an initiation of a traffic session (e.g., an extended reality session) at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The communications manager **720** may be configured as or otherwise support a means for communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information.

[0108] By including or configuring the communications manager **720** in accordance with examples as described herein, the device **705** (e.g., a processor controlling or otherwise coupled to the receiver **710**, the transmitter **715**, the communications manager **720**, or a combination thereof) may support techniques for uplink scheduling information indications that may provide power saving improvements to the UE, more accurate scheduling of uplink resources at the UE, which may

reduce processing requirements for PDCCH decoding, provide higher reliability and lower latency for XR-related operations, and enhanced user experience, among other benefits.

[0109] FIG. **8** shows a block diagram **800** of a device **805** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The device **805** may be an example of aspects of a device **705** or a UE **115** as described herein. The device **805** may include a receiver **810**, a transmitter **815**, and a communications manager **820**. The device **805** may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

[0110] The receiver **810** may provide a means for receiving information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE indication of uplink scheduling parameters in wireless communications). Information may be passed on to other components of the device **805**. The receiver **810** may utilize a single antenna or a set of multiple antennas.

[0111] The transmitter **815** may provide a means for transmitting signals generated by other components of the device **805**. For example, the transmitter **815** may transmit information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE indication of uplink scheduling parameters in wireless communications). In some examples, the transmitter **815** may be co-located with a receiver **810** in a transceiver module. The transmitter **815** may utilize a single antenna or a set of multiple antennas.

[0112] The device **805**, or various components thereof, may be an example of means for performing various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein. For example, the communications manager **820** may include an XR traffic manager **825** a scheduling manager **830**, or any combination thereof. The communications manager **820** may be an example of aspects of a communications manager **720** as described herein. In some examples, the communications manager **820**, or various components thereof, may be configured to perform various operations (e.g., receiving, monitoring, transmitting) using or otherwise in cooperation with the receiver **810**, the transmitter **815**, or both. For example, the communications manager **820** may receive information from the receiver **810**, send information to the transmitter **815**, or be integrated in combination with the receiver **810**, the transmitter **815**, or both to receive information, transmit information, or perform various other operations as described herein.

[0113] The communications manager **820** may support wireless communication at a UE in accordance with examples as disclosed herein. The XR traffic manager **825** may be configured as or otherwise support a means for transmitting, responsive to an initiation of a traffic session (e.g., an extended reality session) at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The scheduling manager **830** may be configured as or otherwise support a means for communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information.

[0114] FIG. **9** shows a block diagram **900** of a communications manager **920** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The communications manager **920** may be an example of aspects of a communications manager **720**, a communications manager **820**, or both, as described herein. The communications manager **920**, or various components thereof, may be an example of means for performing various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein. For example, the communications manager **920** may include an XR traffic manager **925**, a scheduling manager **930**, a UL skipping manager **935**, a sleep manager **940**, an RRC manager **945**, or any combination thereof. Each of these components may

communicate, directly or indirectly, with one another (e.g., via one or more buses).

[0115] The communications manager **920** may support wireless communication at a UE in accordance with examples as disclosed herein. The XR traffic manager **925** may be configured as or otherwise support a means for transmitting, responsive to an initiation of a traffic session at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The scheduling manager **930** may be configured as or otherwise support a means for communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information.

[0116] In some examples, to support transmitting the uplink scheduling information, the XR traffic manager **925** may be configured as or otherwise support a means for transmitting, to the base station, one or more of a UE assistance information (UAI) communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE.

[0117] In some examples, the UAI is associated with an extended reality session and includes one or more of a requested periodicity of uplink traffic, a requested offset of uplink traffic, a requested data size for uplink traffic for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof. In some examples, the UAI includes one or more of a requested periodicity of uplink grants, a requested offset of uplink grants, a requested data size for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof.

[0118] In some examples, the scheduling manager **930** may be configured as or otherwise support a means for receiving, from the base station, an uplink scheduling pattern that is based at least in part on the UAI.

[0119] In some examples, the sleep manager **940** may be configured as or otherwise support a means for transitioning to a sleep mode between consecutive uplink grants based at least in part on the uplink scheduling pattern. In some examples, the uplink scheduling pattern provides that uplink communications to the base station and downlink communications from the base station are coordinated to provide additional duration of the sleep mode relative to cases where UAI is unused in deriving the uplink scheduling pattern. In some examples, at least a portion of the uplink scheduling pattern is received in RRC signaling. In some examples, the uplink scheduling pattern provides one or more of a configured grant for the UE, an enablement of uplink transmission skipping, a sounding reference signal configuration, a channel state information report configuration, a DRX configuration, or any combinations thereof. In some examples, the enablement of uplink transmission skipping indicates that the UE can skip an uplink shared channel communication when the UE does not have uplink data to transmit.

[0120] In some examples, the scheduling manager **930** may be configured as or otherwise support a means for receiving, from the base station, one or more proactive grants for one or more uplink communications. In some examples, the UL skipping manager **935** may be configured as or otherwise support a means for where the uplink scheduling information provides an uplink skipping indication that one or more subsequent proactive grants will be unmonitored by the UE. In some examples, the uplink skipping indication identifies that the one or more subsequent proactive grants will be unmonitored for a first time period or until a specific time. In some examples, the first time period or the specific time correspond to a start of a subsequent downlink burst of the traffic session.

[0121] In some examples, the uplink skipping indication is an explicit indication provided in a scheduling request that is transmitted to the base station. In some examples, the uplink skipping indication is provided in a medium access control (MAC) control element (CE) in which a BSR indication is set to zero. In some examples, the uplink skipping indication is provided by setting an

inactivity timer of the UE to a value that initiates a DRX sleep state. In some examples, the uplink skipping indication is provided as a layer-one request that is transmitted in uplink control information to the base station.

[0122] FIG. **10** shows a diagram of a system **1000** including a device **1005** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The device **1005** may be an example of or include the components of a device **705**, a device **805**, or a UE **115** as described herein. The device **1005** may communicate wirelessly with one or more base stations **105**, UEs **115**, or any combination thereof. The device **1005** may include components for bi-directional voice and data communications including components for transmitting and receiving communications, such as a communications manager **1020**, an input/output (I/O) controller **1010**, a transceiver **1015**, an antenna **1025**, a memory **1030**, code **1035**, and a processor **1040**. These components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more buses (e.g., a bus **1045**).

[0123] The I/O controller **1010** may manage input and output signals for the device **1005**. The I/O controller **1010** may also manage peripherals not integrated into the device **1005**. In some cases, the I/O controller **1010** may represent a physical connection or port to an external peripheral. In some cases, the I/O controller **1010** may utilize an operating system such as iOS®, ANDROID®, MS-DOS®, MS-WINDOWS®, OS/2®, UNIX®, LINUX®, or another known operating system. Additionally or alternatively, the I/O controller **1010** may represent or interact with a modem, a keyboard, a mouse, a touchscreen, or a similar device. In some cases, the I/O controller **1010** may be implemented as part of a processor, such as the processor **1040**. In some cases, a user may interact with the device **1005** via the I/O controller **1010** or via hardware components controlled by the I/O controller **1010**.

[0124] In some cases, the device **1005** may include a single antenna **1025**. However, in some other cases, the device **1005** may have more than one antenna **1025**, which may be capable of concurrently transmitting or receiving multiple wireless transmissions. The transceiver **1015** may communicate bi-directionally, via the one or more antennas **1025**, wired, or wireless links as described herein. For example, the transceiver **1015** may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver **1015** may also include a modem to modulate the packets, to provide the modulated packets to one or more antennas **1025** for transmission, and to demodulate packets received from the one or more antennas **1025**. The transceiver **1015**, or the transceiver **1015** and one or more antennas **1025**, may be an example of a transmitter **715**, a transmitter **815**, a receiver **710**, a receiver **810**, or any combination thereof or component thereof, as described herein.

[0125] The memory **1030** may include random access memory (RAM) and read-only memory (ROM). The memory **1030** may store computer-readable, computer-executable code **1035** including instructions that, when executed by the processor **1040**, cause the device **1005** to perform various functions described herein. The code **1035** may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. In some cases, the code **1035** may not be directly executable by the processor **1040** but may cause a computer (e.g., when compiled and executed) to perform functions described herein. In some cases, the memory **1030** may contain, among other things, a basic I/O system (BIOS) which may control basic hardware or software operation such as the interaction with peripheral components or devices.

[0126] The processor **1040** may include an intelligent hardware device (e.g., a general-purpose processor, a DSP, a CPU, a GPU, a microcontroller, an ASIC, an FPGA, a programmable logic device, a discrete gate or transistor logic component, a discrete hardware component, or any combination thereof). In some cases, the processor **1040** may be configured to operate a memory array using a memory controller. In some other cases, a memory controller may be integrated into the processor **1040**. The processor **1040** may be configured to execute computer-readable

instructions stored in a memory (e.g., the memory **1030**) to cause the device **1005** to perform various functions (e.g., functions or tasks supporting UE indication of uplink scheduling parameters in wireless communications). For example, the device **1005** or a component of the device **1005** may include a processor **1040** and memory **1030** coupled to the processor **1040**, the processor **1040** and memory **1030** configured to perform various functions described herein.

[0127] The communications manager **1020** may support wireless communication at a UE in accordance with examples as disclosed herein. For example, the communications manager **1020** may be configured as or otherwise support a means for transmitting, responsive to an initiation of a traffic session (e.g., an extended reality session) at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The communications manager **1020** may be configured as or otherwise support a means for communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information.

[0128] By including or configuring the communications manager **1020** in accordance with examples as described herein, the device **1005** may support techniques for indications of uplink scheduling information that may provide power saving improvements to the UE (e.g., through increased durations of sleep periods), may allow for more accurate scheduling of uplink resources at the UE, may promote higher reliability and lower latency for XR-related operations, and provide enhanced user experience, among other benefits. Further, UE indication of PUSCH skipping may allow a base station to discontinue associated PDCCH transmissions, and thereby allow associated resources to be allocated for other communications, allowing for enhancements in network resource usage which may further promote higher reliability, lower latency, and enhance overall network capacity.

[0129] In some examples, the communications manager **1020** may be configured to perform various operations (e.g., receiving, monitoring, transmitting) using or otherwise in cooperation with the transceiver **1015**, the one or more antennas **1025**, or any combination thereof. Although the communications manager **1020** is illustrated as a separate component, in some examples, one or more functions described with reference to the communications manager **1020** may be supported by or performed by the processor **1040**, the memory **1030**, the code **1035**, or any combination thereof. For example, the code **1035** may include instructions executable by the processor **1040** to cause the device **1005** to perform various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein, or the processor **1040** and the memory **1030** may be otherwise configured to perform or support such operations.

[0130] FIG. **11** shows a block diagram **1100** of a device **1105** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The device **1105** may be an example of aspects of a base station **105** as described herein. The device **1105** may include a receiver **1110**, a transmitter **1115**, and a communications manager **1120**. The device **1105** may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

[0131] The receiver **1110** may provide a means for receiving information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE indication of uplink scheduling parameters in wireless communications). Information may be passed on to other components of the device **1105**. The receiver **1110** may utilize a single antenna or a set of multiple antennas.

[0132] The transmitter **1115** may provide a means for transmitting signals generated by other components of the device **1105**. For example, the transmitter **1115** may transmit information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE

indication of uplink scheduling parameters in wireless communications). In some examples, the transmitter **1115** may be co-located with a receiver **1110** in a transceiver module. The transmitter **1115** may utilize a single antenna or a set of multiple antennas.

[0133] The communications manager **1120**, the receiver **1110**, the transmitter **1115**, or various combinations thereof or various components thereof may be examples of means for performing various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein. For example, the communications manager **1120**, the receiver **1110**, the transmitter **1115**, or various combinations or components thereof may support a method for performing one or more of the functions described herein.

[0134] In some examples, the communications manager **1120**, the receiver **1110**, the transmitter **1115**, or various combinations or components thereof may be implemented in hardware (e.g., in communications management circuitry). The hardware may include a processor, a DSP, an ASIC, an FPGA or other programmable logic device, a discrete gate or transistor logic, discrete hardware components, or any combination thereof configured as or otherwise supporting a means for performing the functions described in the present disclosure. In some examples, a processor and memory coupled with the processor may be configured to perform one or more of the functions described herein (e.g., by executing, by the processor, instructions stored in the memory).

[0135] Additionally or alternatively, in some examples, the communications manager **1120**, the receiver **1110**, the transmitter **1115**, or various combinations or components thereof may be implemented in code (e.g., as communications management software) executed by a processor. If implemented in code executed by a processor, the functions of the communications manager **1120**, the receiver **1110**, the transmitter **1115**, or various combinations or components thereof may be performed by a general-purpose processor, a DSP, a CPU, a GPU, an ASIC, an FPGA, or any combination of these or other programmable logic devices (e.g., configured as or otherwise supporting a means for performing the functions described in the present disclosure).

[0136] In some examples, the communications manager **1120** may be configured to perform various operations (e.g., receiving, monitoring, transmitting) using or otherwise in cooperation with the receiver **1110**, the transmitter **1115**, or both. For example, the communications manager **1120** may receive information from the receiver **1110**, send information to the transmitter **1115**, or be integrated in combination with the receiver **1110**, the transmitter **1115**, or both to receive information, transmit information, or perform various other operations as described herein.

[0137] The communications manager **1120** may support wireless communication at a base station in accordance with examples as disclosed herein. For example, the communications manager **1120** may be configured as or otherwise support a means for receiving, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The communications manager **1120** may be configured as or otherwise support a means for communicating with the UE to receive or transmit data associated with the traffic session based at least in part on the uplink scheduling information.

[0138] By including or configuring the communications manager **1120** in accordance with examples as described herein, the device **1105** (e.g., a processor controlling or otherwise coupled to the receiver **1110**, the transmitter **1115**, the communications manager **1120**, or a combination thereof) may support techniques for indications of uplink scheduling information that may provide power saving improvements to the UE, may allow for more accurate scheduling of uplink resources, may promote higher reliability and lower latency for XR-related operations, and provide enhanced user experience, among other benefits.

[0139] FIG. **12** shows a block diagram **1200** of a device **1205** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The device **1205** may be an example of aspects of a device **1105** or a base station **105** as

described herein. The device **1205** may include a receiver **1210**, a transmitter **1215**, and a communications manager **1220**. The device **1205** may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

[0140] The receiver **1210** may provide a means for receiving information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE indication of uplink scheduling parameters in wireless communications). Information may be passed on to other components of the device **1205**. The receiver **1210** may utilize a single antenna or a set of multiple antennas.

[0141] The transmitter **1215** may provide a means for transmitting signals generated by other components of the device **1205**. For example, the transmitter **1215** may transmit information such as packets, user data, control information, or any combination thereof associated with various information channels (e.g., control channels, data channels, information channels related to UE indication of uplink scheduling parameters in wireless communications). In some examples, the transmitter **1215** may be co-located with a receiver **1210** in a transceiver module. The transmitter **1215** may utilize a single antenna or a set of multiple antennas.

[0142] The device **1205**, or various components thereof, may be an example of means for performing various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein. For example, the communications manager **1220** may include an XR traffic manager **1225** a scheduling manager **1230**, or any combination thereof. The communications manager **1220** may be an example of aspects of a communications manager **1120** as described herein. In some examples, the communications manager **1220**, or various components thereof, may be configured to perform various operations (e.g., receiving, monitoring, transmitting) using or otherwise in cooperation with the receiver **1210**, the transmitter **1215**, or both. For example, the communications manager **1220** may receive information from the receiver **1210**, send information to the transmitter **1215**, or be integrated in combination with the receiver **1210**, the transmitter **1215**, or both to receive information, transmit information, or perform various other operations as described herein.

[0143] The communications manager **1220** may support wireless communication at a base station in accordance with examples as disclosed herein. The XR traffic manager **1225** may be configured as or otherwise support a means for receiving, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The scheduling manager **1230** may be configured as or otherwise support a means for communicating with the UE to receive or transmit data associated with the traffic session based at least in part on the uplink scheduling information.

[0144] FIG. **13** shows a block diagram **1300** of a communications manager **1320** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The communications manager **1320** may be an example of aspects of a communications manager **1120**, a communications manager **1220**, or both, as described herein. The communications manager **1320**, or various components thereof, may be an example of means for performing various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein. For example, the communications manager **1320** may include an XR traffic manager **1325**, a scheduling manager **1330**, a UL skipping manager **1335**, an RRC manager **1340**, or any combination thereof. Each of these components may communicate, directly or indirectly, with one another (e.g., via one or more buses).

[0145] The communications manager **1320** may support wireless communication at a base station in accordance with examples as disclosed herein. The XR traffic manager **1325** may be configured as or otherwise support a means for receiving, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters

associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The scheduling manager **1330** may be configured as or otherwise support a means for communicating with the UE to receive or transmit data associated with the traffic session based at least in part on the uplink scheduling information. In some examples, the uplink scheduling information includes one or more of a UE assistance information (UAI) communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE. In some examples, the UAI is associated with an extended reality session and includes one or more of a requested periodicity of uplink traffic, a requested offset of uplink traffic, a requested data size for uplink traffic for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof. In some examples, the UAI includes one or more of a requested periodicity of uplink grants, a requested offset of uplink grants, a requested data size for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof.

[0146] In some examples, the scheduling manager **1330** may be configured as or otherwise support a means for transmitting, to the UE, an uplink scheduling pattern that is based at least in part on the UAI. In some examples, the uplink scheduling pattern provides that uplink communications from the UE and downlink communications to the UE are coordinated to provide additional duration of a sleep mode at the UE relative to cases where UAI is unused in deriving the uplink scheduling pattern. In some examples, at least a portion of the uplink scheduling pattern is transmitted to the UE in RRC signaling. In some examples, the uplink scheduling pattern provides one or more of a configured grant for the UE, an enablement of uplink transmission skipping, a sounding reference signal configuration, a channel state information report configuration, a DRX configuration, or any combinations thereof. In some examples, the enablement of uplink transmission skipping indicates that the UE can skip an uplink shared channel communication when the UE does not have uplink data to transmit.

[0147] In some examples, the UL skipping manager **1335** may be configured as or otherwise support a means for transmitting, to the UE, one or more proactive grants for one or more uplink communications associated with the traffic session, and where the uplink scheduling information provides an uplink skipping indication that one or more subsequent proactive grants will be unmonitored by the UE. In some examples, the scheduling manager **1330** may be configured as or otherwise support a means for discontinuing transmitting the one or more proactive grants to the UE responsive to the uplink skipping indication.

[0148] In some examples, the uplink skipping indication identifies that the one or more subsequent proactive grants will be unmonitored for a first time period or until a specific time, and where the transmitting of the one or more proactive grants is discontinued for the first time period or until the specific time. In some examples, the first time period or the specific time correspond to a start of a subsequent downlink burst of the traffic session. In some examples, the uplink skipping indication is an explicit indication provided in a scheduling request that is received from the UE. In some examples, the uplink skipping indication is provided in a MAC-CE in which a BSR indication is set to zero. In some examples, the uplink skipping indication is provided by setting an inactivity timer of the UE to a value that initiates a DRX sleep state. In some examples, the uplink skipping indication is provided as a layer-one request that is transmitted in uplink control information from the UE.

[0149] FIG. **14** shows a diagram of a system **1400** including a device **1405** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The device **1405** may be an example of or include the components of a device **1105**, a device **1205**, or a base station **105** as described herein. The device **1405** may communicate wirelessly with one or more base stations **105**, UEs **115**, or any combination thereof. The device **1405** may include components for bi-directional voice and data communications

including components for transmitting and receiving communications, such as a communications manager **1420**, a network communications manager **1410**, a transceiver **1415**, an antenna **1425**, a memory **1430**, code **1435**, a processor **1440**, and an inter-station communications manager **1445**. These components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more buses (e.g., a bus **1450**).

[0150] The network communications manager **1410** may manage communications with a core network **130** (e.g., via one or more wired backhaul links). For example, the network communications manager **1410** may manage the transfer of data communications for client devices, such as one or more UEs **115**.

[0151] In some cases, the device **1405** may include a single antenna **1425**. However, in some other cases the device **1405** may have more than one antenna **1425**, which may be capable of concurrently transmitting or receiving multiple wireless transmissions. The transceiver **1415** may communicate bi-directionally, via the one or more antennas **1425**, wired, or wireless links as described herein. For example, the transceiver **1415** may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver **1415** may also include a modem to modulate the packets, to provide the modulated packets to one or more antennas **1425** for transmission, and to demodulate packets received from the one or more antennas **1425**. The transceiver **1415**, or the transceiver **1415** and one or more antennas **1425**, may be an example of a transmitter **1115**, a transmitter **1215**, a receiver **1110**, a receiver **1210**, or any combination thereof or component thereof, as described herein.

[0152] The memory **1430** may include RAM and ROM. The memory **1430** may store computer-readable, computer-executable code **1435** including instructions that, when executed by the processor **1440**, cause the device **1405** to perform various functions described herein. The code **1435** may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. In some cases, the code **1435** may not be directly executable by the processor **1440** but may cause a computer (e.g., when compiled and executed) to perform functions described herein. In some cases, the memory **1430** may contain, among other things, a BIOS which may control basic hardware or software operation such as the interaction with peripheral components or devices.

[0153] The processor **1440** may include an intelligent hardware device (e.g., a general-purpose processor, a DSP, a CPU, a GPU, a microcontroller, an ASIC, an FPGA, a programmable logic device, a discrete gate or transistor logic component, a discrete hardware component, or any combination thereof). In some cases, the processor **1440** may be configured to operate a memory array using a memory controller. In some other cases, a memory controller may be integrated into the processor **1440**. The processor **1440** may be configured to execute computer-readable instructions stored in a memory (e.g., the memory **1430**) to cause the device **1405** to perform various functions (e.g., functions or tasks supporting UE indication of uplink scheduling parameters in wireless communications). For example, the device **1405** or a component of the device **1405** may include a processor **1440** and memory **1430** coupled to the processor **1440**, the processor **1440** and memory **1430** configured to perform various functions described herein.

[0154] The inter-station communications manager **1445** may manage communications with other base stations **105**, and may include a controller or scheduler for controlling communications with UEs **115** in cooperation with other base stations **105**. For example, the inter-station communications manager **1445** may coordinate scheduling for transmissions to UEs **115** for various interference mitigation techniques such as beamforming or joint transmission. In some examples, the inter-station communications manager **1445** may provide an X2 interface within an LTE/LTE-A wireless communications network technology to provide communication between base stations **105**.

[0155] The communications manager **1420** may support wireless communication at a base station in accordance with examples as disclosed herein. For example, the communications manager **1420**

may be configured as or otherwise support a means for receiving, from a UE responsive to an initiation of a traffic session (e.g., an extended reality session) at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The communications manager **1420** may be configured as or otherwise support a means for communicating with the UE to receive or transmit data associated with the traffic session based at least in part on the uplink scheduling information.

[0156] By including or configuring the communications manager **1420** in accordance with examples as described herein, the device **1405** may support techniques for indications of uplink scheduling information that may provide power saving improvements to the UE (e.g., through increased durations of sleep periods), may allow for more accurate scheduling of uplink and downlink resources, may promote higher reliability and lower latency for wireless communications as well as for XR-related operations, and provide enhanced user experience, among other benefits. Further, UE indication of PUSCH skipping may allow the base station to discontinue associated PDCCH transmissions, and thereby allow associated resources to be allocated for other communications, allowing for enhancements in network resource usage which may further promote higher reliability, lower latency, and enhance overall network capacity.

[0157] In some examples, the communications manager **1420** may be configured to perform various operations (e.g., receiving, monitoring, transmitting) using or otherwise in cooperation with the transceiver **1415**, the one or more antennas **1425**, or any combination thereof. Although the communications manager **1420** is illustrated as a separate component, in some examples, one or more functions described with reference to the communications manager **1420** may be supported by or performed by the processor **1440**, the memory **1430**, the code **1435**, or any combination thereof. For example, the code **1435** may include instructions executable by the processor **1440** to cause the device **1405** to perform various aspects of UE indication of uplink scheduling parameters in wireless communications as described herein, or the processor **1440** and the memory **1430** may be otherwise configured to perform or support such operations.

[0158] FIG. **15** shows a flowchart illustrating a method **1500** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The operations of the method **1500** may be implemented by a UE or its components as described herein. For example, the operations of the method **1500** may be performed by a UE **115** as described with reference to FIGS. **1** through **10**. In some examples, a UE may execute a set of instructions to control the functional elements of the UE to perform the described functions. Additionally or alternatively, the UE may perform aspects of the described functions using special-purpose hardware.

[0159] At **1505**, the method may include transmitting, responsive to an initiation of a traffic session at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The operations of **1505** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1505** may be performed by an XR traffic manager **925** as described with reference to FIG. **9**.

[0160] At **1510**, the method may include communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information. The operations of **1510** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1510** may be performed by a scheduling manager **930** as described with reference to FIG. **9**.

[0161] FIG. **16** shows a flowchart illustrating a method **1600** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The operations of the method **1600** may be implemented by a UE or its components as

described herein. For example, the operations of the method **1600** may be performed by a UE **115** as described with reference to FIGS. **1** through **10**. In some examples, a UE may execute a set of instructions to control the functional elements of the UE to perform the described functions. Additionally or alternatively, the UE may perform aspects of the described functions using special-purpose hardware.

[0162] At **1605**, the method may include transmitting, to the base station, one or more of a UAI communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE. The operations of **1605** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1605** may be performed by an XR traffic manager **925** as described with reference to FIG. **9**.

[0163] At **1610**, the method may include receiving, from the base station, an uplink scheduling pattern that is based at least in part on the UAI. The operations of **1610** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1610** may be performed by a scheduling manager **930** as described with reference to FIG. **9**.

[0164] At **1615**, the method may include communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information. The operations of **1615** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1615** may be performed by a scheduling manager **930** as described with reference to FIG. **9**.

[0165] At **1620**, the method may include transitioning to a sleep mode between consecutive uplink grants based at least in part on the uplink scheduling pattern. The operations of **1620** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1620** may be performed by a sleep manager **940** as described with reference to FIG. **9**.

[0166] FIG. **17** shows a flowchart illustrating a method **1700** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The operations of the method **1700** may be implemented by a UE or its components as described herein. For example, the operations of the method **1700** may be performed by a UE **115** as described with reference to FIGS. **1** through **10**. In some examples, a UE may execute a set of instructions to control the functional elements of the UE to perform the described functions. Additionally or alternatively, the UE may perform aspects of the described functions using special-purpose hardware.

[0167] At **1705**, the method may include receiving, from a base station, one or more proactive grants for one or more uplink communications. The operations of **1705** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1705** may be performed by a scheduling manager **930** as described with reference to FIG. **9**.

[0168] At **1710**, the method may include transmitting, responsive to an initiation of a traffic session at the UE, uplink scheduling information to the base station, the uplink scheduling information indicating that one or more subsequent proactive grants will be unmonitored by the UE. The operations of **1710** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1710** may be performed by an UL skipping manager **935** as described with reference to FIG. **9**.

[0169] At **1715**, the method may include communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information. The operations of **1715** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1715** may be performed by a scheduling manager **930** as described with reference to FIG. **9**.

[0170] FIG. **18** shows a flowchart illustrating a method **1800** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present

disclosure. The operations of the method **1800** may be implemented by a base station or its components as described herein. For example, the operations of the method **1800** may be performed by a base station **105** as described with reference to FIGS. **1** through **6** and **11** through **14**. In some examples, a base station may execute a set of instructions to control the functional elements of the base station to perform the described functions. Additionally or alternatively, the base station may perform aspects of the described functions using special-purpose hardware.

[0171] At **1805**, the method may include receiving, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session. The operations of **1805** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1805** may be performed by an XR traffic manager **1325** as described with reference to FIG. **13**. In some cases, the uplink scheduling information includes one or more of a UAI communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE.

[0172] At **1810**, the method may include communicating with the UE to receive or transmit data associated with the traffic session based at least in part on the uplink scheduling information. The operations of **1810** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1810** may be performed by a scheduling manager **1330** as described with reference to FIG. **13**.

[0173] FIG. **19** shows a flowchart illustrating a method **1900** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The operations of the method **1900** may be implemented by a base station or its components as described herein. For example, the operations of the method **1900** may be performed by a base station **105** as described with reference to FIGS. **1** through **6** and **11** through **14**. In some examples, a base station may execute a set of instructions to control the functional elements of the base station to perform the described functions. Additionally or alternatively, the base station may perform aspects of the described functions using special-purpose hardware.

[0174] At **1905**, the method may include receiving, from a UE responsive to an initiation of a traffic session at the UE, a UAI communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE. The operations of **1905** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1905** may be performed by an XR traffic manager **1325** as described with reference to FIG. **13**.

[0175] At **1910**, the method may include communicating with the UE to receive or transmit data associated with the traffic session based at least in part on the UAI or uplink skipping indication. The operations of **1910** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1910** may be performed by a scheduling manager **1330** as described with reference to FIG. **13**.

[0176] FIG. **20** shows a flowchart illustrating a method **2000** that supports UE indication of uplink scheduling parameters in wireless communications in accordance with aspects of the present disclosure. The operations of the method **2000** may be implemented by a base station or its components as described herein. For example, the operations of the method **2000** may be performed by a base station **105** as described with reference to FIGS. **1** through **6** and **11** through **14**. In some examples, a base station may execute a set of instructions to control the functional elements of the base station to perform the described functions. Additionally or alternatively, the base station may perform aspects of the described functions using special-purpose hardware.

[0177] At **2005**, the method may include transmitting, to the UE, one or more proactive grants for one or more uplink communications associated with a traffic session. The operations of **2005** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the

operations of **2005** may be performed by a UL skipping manager **1335** as described with reference to FIG. **13**.

[0178] At **2010**, the method may include receiving, from the UE responsive to an initiation of the traffic session, uplink scheduling information that provides an uplink skipping indication that one or more subsequent proactive grants will be unmonitored by the UE. The operations of **2010** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **2010** may be performed by an XR traffic manager **1325** as described with reference to FIG. **13**.

[0179] At **2015**, the method may include discontinuing transmitting the one or more proactive grants to the UE responsive to the uplink skipping indication. The operations of **2015** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **2015** may be performed by a scheduling manager **1330** as described with reference to FIG. **13**.

[0180] The following provides an overview of aspects of the present disclosure:

[0181] Aspect 1: A method for wireless communication at a UE, comprising: transmitting, responsive to an initiation of a traffic session at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session; and communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information.

[0182] Aspect 2: The method of aspect 1, wherein the transmitting the uplink scheduling information comprises: transmitting, to the base station, one or more of a UE assistance information (UAI) communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE.

[0183] Aspect 3: The method of aspect 2, wherein the UAI is associated with an extended reality session and includes one or more of a requested periodicity of uplink traffic, a requested offset of uplink traffic, a requested data size for uplink traffic for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof.

[0184] Aspect 4: The method of any of aspects 2 through 3, wherein the UAI includes one or more of a requested periodicity of uplink grants, a requested offset of uplink grants, a requested data size for each time period associated with the traffic session, a request to enable uplink transmission skipping, or any combinations thereof.

[0185] Aspect 5: The method of any of aspects 2 through 4, further comprising: receiving, from the base station, an uplink scheduling pattern that is based at least in part on the UAI.

[0186] Aspect 6: The method of aspect 5, further comprising: transitioning to a sleep mode between consecutive uplink grants based at least in part on the uplink scheduling pattern.

[0187] Aspect 7: The method of aspect 6, wherein the uplink scheduling pattern provides that uplink communications to the base station and downlink communications from the base station are coordinated to provide additional duration of the sleep mode relative to cases where UAI is unused in deriving the uplink scheduling pattern.

[0188] Aspect 8: The method of any of aspects 5 through 7, wherein at least a portion of the uplink scheduling pattern is received in RRC signaling.

[0189] Aspect 9: The method of aspect 8, wherein the uplink scheduling pattern provides one or more of a configured grant for the UE, an enablement of uplink transmission skipping, a sounding reference signal configuration, a channel state information report configuration, a DRX configuration, or any combinations thereof.

[0190] Aspect 10: The method of aspect 9, wherein the enablement of uplink transmission skipping indicates that the UE can skip an uplink shared channel communication when the UE does not have

uplink data to transmit.

[0191] Aspect 11: The method of aspect 1, further comprising: receiving, from the base station, one or more proactive grants for one or more uplink communications; and wherein the uplink scheduling information provides an uplink skipping indication that one or more subsequent proactive grants will be unmonitored by the UE.

[0192] Aspect 12: The method of aspect 11, wherein the uplink skipping indication identifies that the one or more subsequent proactive grants will be unmonitored for a first time period or until a specific time.

[0193] Aspect 13: The method of aspect 12, wherein the first time period or the specific time correspond to a start of a subsequent downlink burst of the traffic session.

[0194] Aspect 14: The method of any of aspects 11 through 13, wherein the uplink skipping indication is an explicit indication provided in a scheduling request that is transmitted to the base station.

[0195] Aspect 15: The method of any of aspects 11 through 14, wherein the uplink skipping indication is provided in a medium access control (MAC) control element (CE) in which a buffer status report (BSR) indication is set to zero.

[0196] Aspect 16: The method of any of aspects 11 through 15, wherein the uplink skipping indication is provided by setting an inactivity timer of the UE to a value that initiates a DRX sleep state.

[0197] Aspect 17: The method of any of aspects 11 through 16, wherein the uplink skipping indication is provided as a layer-one request that is transmitted in uplink control information to the base station.

[0198] Aspect 18: A method for wireless communication at a base station, comprising: receiving, from a UE responsive to an initiation of a traffic session at the UE, uplink scheduling information that indicates one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session; and communicating with the UE to receive or transmit data associated with the traffic session based at least in part on the uplink scheduling information.

[0199] Aspect 19: The method of aspect 18, wherein the uplink scheduling information includes one or more of a UE assistance information (UAI) communication that indicates parameters for the pattern of uplink resources or an uplink skipping indication that one or more proactive uplink grants are to be skipped by the UE.

[0200] Aspect 20: The method of aspect 19, wherein the UAI is associated with an extended reality session and includes one or more of a requested periodicity of uplink traffic, a requested offset of uplink traffic, a requested data size for uplink traffic for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof.

[0201] Aspect 21: The method of any of aspects 19 through 20, wherein the UAI includes one or more of a requested periodicity of uplink grants, a requested offset of uplink grants, a requested data size for each time period associated with the extended reality session, a request to enable uplink transmission skipping, or any combinations thereof.

[0202] Aspect 22: The method of any of aspects 19 through 21, further comprising: transmitting, to the UE, an uplink scheduling pattern that is based at least in part on the UAI.

[0203] Aspect 23: The method of aspect 22, wherein the uplink scheduling pattern provides that uplink communications from the UE and downlink communications to the UE are coordinated to provide additional duration of a sleep mode at the UE relative to cases where UAI is unused in deriving the uplink scheduling pattern.

[0204] Aspect 24: The method of any of aspects 22 through 23, wherein at least a portion of the uplink scheduling pattern is transmitted to the UE in RRC signaling.

[0205] Aspect 25: The method of aspect 24, wherein the uplink scheduling pattern provides one or

more of a configured grant for the UE, an enablement of uplink transmission skipping, a sounding reference signal configuration, a channel state information report configuration, a DRX configuration, or any combinations thereof.

[0206] Aspect 26: The method of aspect 25, wherein the enablement of uplink transmission skipping indicates that the UE can skip an uplink shared channel communication when the UE does not have uplink data to transmit.

[0207] Aspect 27: The method of aspect 18, further comprising: transmitting, to the UE, one or more proactive grants for one or more uplink communications associated with the traffic session, and wherein the uplink scheduling information provides an uplink skipping indication that one or more subsequent proactive grants will be unmonitored by the UE; and discontinuing transmitting the one or more proactive grants to the UE responsive to the uplink skipping indication.

[0208] Aspect 28: The method of aspect 27, wherein the uplink skipping indication identifies that the one or more subsequent proactive grants will be unmonitored for a first time period or until a specific time, and wherein the transmitting of the one or more proactive grants is discontinued for the first time period or until the specific time.

[0209] Aspect 29: The method of aspect 28, wherein the first time period or the specific time correspond to a start of a subsequent downlink burst of the traffic session.

[0210] Aspect 30: The method of any of aspects 27 through 29, wherein the uplink skipping indication is an explicit indication provided in a scheduling request that is received from the UE.

[0211] Aspect 31: The method of any of aspects 27 through 30, wherein the uplink skipping indication is provided in a medium access control (MAC) control element (CE) in which a buffer status report (BSR) indication is set to zero.

[0212] Aspect 32: The method of any of aspects 27 through 31, wherein the uplink skipping indication is provided by setting an inactivity timer of the UE to a value that initiates a DRX sleep state.

[0213] Aspect 33: The method of any of aspects 27 through 32, wherein the uplink skipping indication is provided as a layer-one request that is transmitted in uplink control information from the UE.

[0214] Aspect 34: An apparatus for wireless communication at a UE, comprising at least one processor; memory coupled with the at least one processor; and instructions stored in the memory and executable by the at least one processor to cause the apparatus to perform a method of any of aspects 1 through 17.

[0215] Aspect 35: An apparatus for wireless communication at a UE, comprising at least one means for performing a method of any of aspects 1 through 17.

[0216] Aspect 36: A non-transitory computer-readable medium storing code for wireless communication at a UE, the code comprising instructions executable by at least one processor to perform a method of any of aspects 1 through 17.

[0217] Aspect 37: An apparatus for wireless communication at a base station, comprising at least one processor; memory coupled with the at least one processor; and instructions stored in the memory and executable by the at least one processor to cause the apparatus to perform a method of any of aspects 18 through 33.

[0218] Aspect 38: An apparatus for wireless communication at a base station, comprising at least one means for performing a method of any of aspects 18 through 33.

[0219] Aspect 39: A non-transitory computer-readable medium storing code for wireless communication at a base station, the code comprising instructions executable by at least one processor to perform a method of any of aspects 18 through 33.

[0220] It should be noted that the methods described herein describe possible implementations, and that the operations and the steps may be rearranged or otherwise modified and that other implementations are possible. Further, aspects from two or more of the methods may be combined.

[0221] Although aspects of an LTE, LTE-A, LTE-A Pro, or NR system may be described for

purposes of example, and LTE, LTE-A, LTE-A Pro, or NR terminology may be used in much of the description, the techniques described herein are applicable beyond LTE, LTE-A, LTE-A Pro, or NR networks. For example, the described techniques may be applicable to various other wireless communications systems such as Ultra Mobile Broadband (UMB), Institute of Electrical and Electronics Engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM, as well as other systems and radio technologies, including future systems and radio technologies, not explicitly mentioned herein.

[0222] Information and signals described herein may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0223] The various illustrative blocks and components described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a DSP, an ASIC, a CPU, a GPU, an FPGA or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices (e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration).

[0224] The functions described herein may be implemented in hardware, software executed by a processor, or any combination thereof. Software shall be construed broadly to mean instructions, instruction sets, code, code segments, program code, programs, subprograms, software modules, applications, software applications, software packages, routines, subroutines, objects, executables, threads of execution, procedures, or functions, etc., whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise. If implemented in software executed by a processor, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Other examples and implementations are within the scope of the disclosure and appended claims. For example, due to the nature of software, functions described herein may be implemented using software executed by a processor, hardware, hardwiring, or combinations of any of these. Features implementing functions may also be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations.

[0225] Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A non-transitory storage medium may be any available medium that may be accessed by a general-purpose or special-purpose computer. By way of example, and not limitation, non-transitory computer-readable media may include RAM, ROM, electrically erasable programmable ROM (EEPROM), flash memory, phase change memory, compact disk (CD) ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other non-transitory medium that may be used to carry or store desired program code means in the form of instructions or data structures and that may be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of computer-readable medium. Disk and disc, as used herein, include CD, laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray

disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above are also included within the scope of computer-readable media.

[0226] As used herein, including in the claims, "or" as used in a list of items (e.g., a list of items prefaced by a phrase such as "at least one of" or "one or more of") indicates an inclusive list such that, for example, a list of at least one of A, B, or C means A or B or C or AB or AC or BC or ABC (i.e., A and B and C). Also, as used herein, the phrase "based on" shall not be construed as a reference to a closed set of conditions. For example, an example step that is described as "based on condition A" may be based on both a condition A and a condition B without departing from the scope of the present disclosure. In other words, as used herein, the phrase "based on" shall be construed in the same manner as the phrase "based at least in part on." As used herein, the term "and/or," when used in a list of two or more items, means that any one of the listed items can be employed by itself, or any combination of two or more of the listed items can be employed. For example, if a composition is described as containing components A, B, and/or C, the composition can contain A alone; B alone; C alone; A and B in combination; A and C in combination; B and C in combination; or A, B, and C in combination.

[0227] In the appended figures, similar components or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If just the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label, or other subsequent reference label.

[0228] The description set forth herein, in connection with the appended drawings, describes example configurations and does not represent all the examples that may be implemented or that are within the scope of the claims. The term "example" used herein means "serving as an example, instance, or illustration," and not "preferred" or "advantageous over other examples." The detailed description includes specific details for the purpose of providing an understanding of the described techniques. These techniques, however, may be practiced without these specific details. In some instances, known structures and devices are shown in block diagram form in order to avoid obscuring the concepts of the described examples.

[0229] The description herein is provided to enable a person having ordinary skill in the art to make or use the disclosure. Various modifications to the disclosure will be apparent to a person having ordinary skill in the art, and the generic principles defined herein may be applied to other variations without departing from the scope of the disclosure. Thus, the disclosure is not limited to the examples and designs described herein but is to be accorded the broadest scope consistent with the principles and novel features disclosed herein.

Claims

1. A method for wireless communication at a user equipment (UE), comprising: transmitting, responsive to an initiation of a traffic session at the UE, uplink scheduling information to a base station, the uplink scheduling information indicating one or more scheduling parameters associated with a pattern of uplink wireless resources for uplink data that is to be transmitted from the UE to the base station during the traffic session; and communicating with the base station to transmit or receive data associated with the traffic session based at least in part on the uplink scheduling information.